GEOLOGICAL ANALYSIS OF THE KIS-ALFÖLD BASED ON SATELLITE-PHOTOS

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The research introduced only in its main results in this study is a part of a five-year scientificic program which was carried out by the Institute of Physical Geography of Attila József University of Sciences within the frame of the theme "Satellite Research of Natural Resources of Hungary" at the commission of the Central Institute of Geology.
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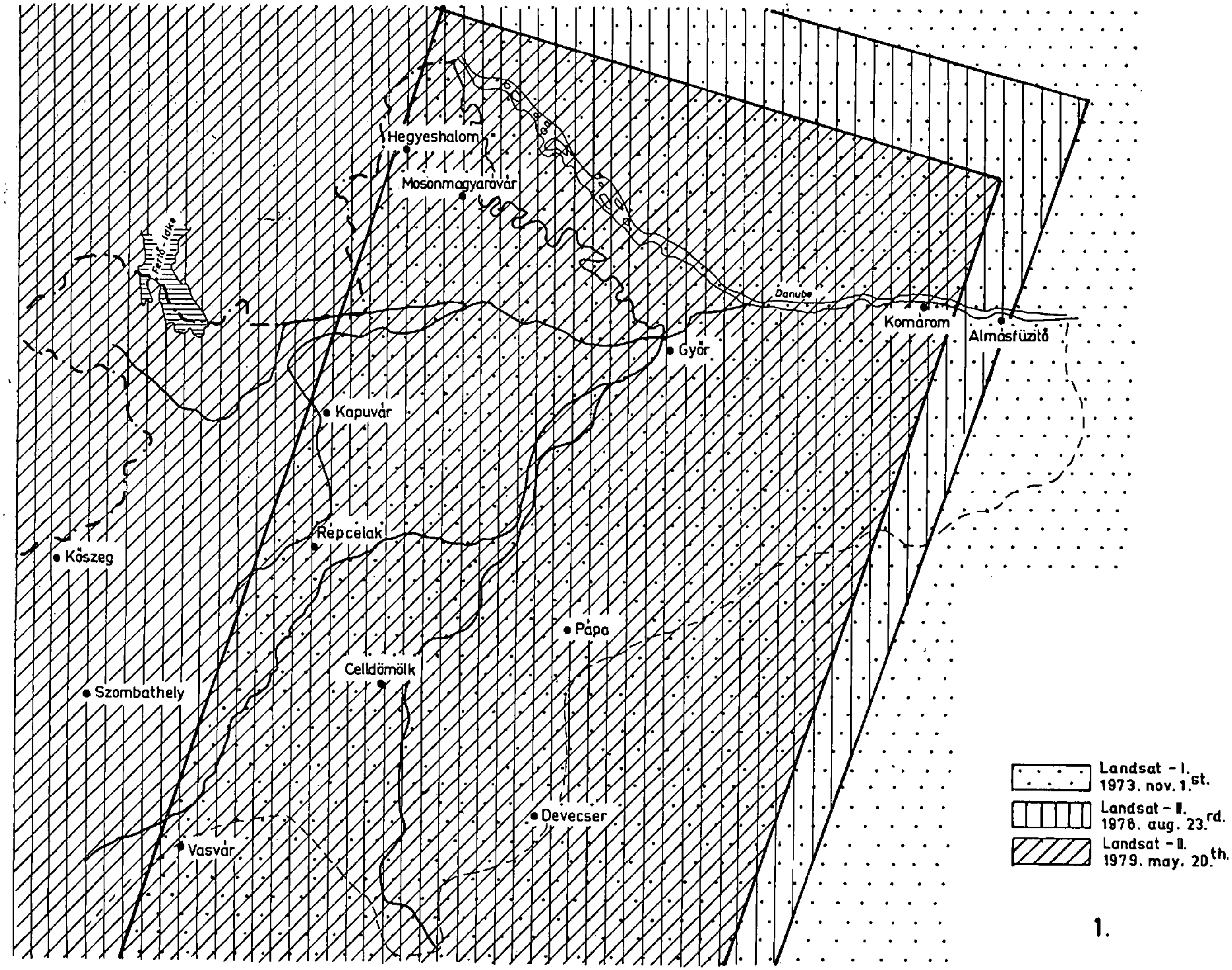
The available LANDSAT longdistance survaillances show that defining the Kis-Alföld as a physical geographical region is a simple task only with a cursory examination because its margins protrude deeply into the wide valley-plains of the bordering Carpathian and Transdanubian rivers. On the satellitephotos of the LANDSAT-satellites (I; II; III.) these marginal regions, which are quastionable and subjectively treatable, too, stand out clearly and this fact helps making a more exact genetic limitation. Yet during our work of interpretation we overstepped the actual borders of the Kis-Alföld for we saw comparation standing out at all points which says that the regionmargins drawn on geomorphological or soilgeographycal basis are not at the same time the margins of the natural factors determining the development of a region. For quality and quantityration of past and recens hydrological, climatological, sedimentational and structural many times determinant) factors determining and directing the geographycal and sedimentological development of the Kis-Alföld are controlled far from the frontier, mainly from the direction of the Alps and the Carpathians.

Yet the investigation of these foreign regions did not fall within our sphere of activity. That is why for morphogenetical relations we tried to choose the satellite-photos so that we could study reaches as long as possible of the mountain water-shed areas of the rivers of the Kis-Alföld. Overstepping especially the Austrian and the Czechoslovakian frontiers as well was absolutely necessary so as to draw a useful comparison between the geographical informations about the foreign parts of this region which is homogeneous as regards the genetics and those of the ones in Hungary.

Unfortunately for our modells of interpretation about the regions abroad not even so could we give everywhere the conditions of the field and deep bore controll up to the level of the required scientific efficiency.

Our investigational region is the second member — according to size — of the


Hegyeshalom
Mosonmagyaróvár
Fertő-lake
Danube
Komárom
Almásfüzitő
Győr
Kapuvár
Repcelak
Kőszeg
Pápa
Celldömölk
Szombathely
Devecser
Vasvár
Landsat - I. 1973. nov. 1.st.
Landsat - II. 1978. aug. 23.rd.
Landsat - II. 1979. may. 20.th.
1.

Danube-basins surroundee by the Alpian-Carpathian montainsystem. It is connected with the smaller Wien-basin towards the west along the Danube dividing the area at the middle through the wide Gates of Bruck and Dévény towards east with the ten times bigger Great Plain through the Pass of Visegrád.

One half of it is in Czechoslovakia to the north of the Danube and its margins protrude deeply into the wide valleys of the Carpathian rivers. To Hungary belongs the other half of it towards the south of the Danube — approximately 5.500 square kilometres — expect the Pandorfi — plateau in Austria.

Its absolute geographycal position is determined by 48 57 33 north latitudes and 16 40 and 1845 west longitudes (L. Góczán).

Since the documentations of our research refer to first of all to the Hungarian territory of the Kis-Alföld, it is reasonable to determine more exactly the borders of the Kis-Alföld as known in the technical literature. According to Góczán (1975) the border of the macroregion is the Danube on the north, the west and south edge of the Fertő-basin on the west, then after turning to the south-south east at Vitnyéd it turns again to the east at Répcelak up to the valley of Rába.

It crosses the Rába at Várkesző, from there runs along the edge of Kemenesalja. The southest border of the region intrudes into the meridional valley of Vindornya down to Óhid, then going round this it turns towards Sümeg, to the north-east. To the north of Sümeg the south-east-east border runs towards Csabrendek then to the north-east up to Halimba across Nyirád. From here the border can be drawn towards the north up to Pápakovácsi, from where it turns to the north-east again and runs in this direction up to the north-north-west along the eastern valley — edge of the creek Sokoro-Bakony, then it goes around the north-western corner of the downs of Pannonhalma. From there it runs toward south-east again along the eastern edge of the downs of Pannonhalma. The south-eastern border is Tápszentmiklós—Kisbér—Szák—Kömlőd—Vértesszőlős. From there it runs to the north along the western feet of Gerecse to the Danube. The border runs to the east along the edge of the Danube riverflats at the feet of the Danube-terraces belonging to the Northern-Gerecse and turns to the north in the direction of Esztergom making a little trough in the basin of Dorog.

The new areal distributions (Pécsi, Góczán) regard Esztergom as the eastern border of the Kis-Alföld since in the Slovakina territory Demek and his collaborators close the border with the valleys of the Garam and the Ipoly. Regiongeographycally the basin of Dorog is the south-eastern edge of the Kis-Alföld with lowland type of regional factors characteristic of it. We shaw the regionborders of the Kis-Alföld as well as the present distribution of our middle and micro regions on fig. 5.

The above described circumscription of the Kis-Alföld is justified by the geomorphological potentialities, the borders of climatic, plantogeographical and soilgeographical regions together (see figs 10. and 15.). On the satellite-photos this region circumscription seems to be really reasonable on most places but on some parts a broarder circumscription could be accepted relying upon the long distance survaillances, for example the LANDSAT-photos there is no difference as regards of the region-characteristics between the Sopron—Vas alluvial cone plain as well as the Kemeneshát and the Kis-Alföld.

And if these territories are still attached to the Western-Hungarian areal distribution of our geomorphologists the only reasons for thos can be the characteristics-a little different from that of the Kis-Alföld — of the other regional factors (a climate with a subalpian — subatlantian effect, vegetation, soilgeography, water-balance) which are reflected less on the satellite-photos.

During our work of interpretation we felt that the borders of regional categories can get new aspects hydrogeographically and geologically-petrographycally. The reliefrelations of the basinbed of the area (figs. 22. 23.) the juxtapositional system, the areal parts with nearly the same geophysical characteristics (figs 25. 26.), the distribution of the larger and smaller geostructural and geokinetical regions, but even the special positions of the contactlines of the different subsoil water regions induced us by means of further reasons not to stichto the regional category of the geographically circumscribed Kis-Alföld in the interpretation of the satellite-photos but to make an effort to the wider overlapping. Otherwise the edges of the available satellite-photos made these overlappings easy, for they cover not only the whole territory of the Kis-Alföld but also its neighbouring parts of regions and just from the direction of the regiongenetically most active western, south-western and northern sides.

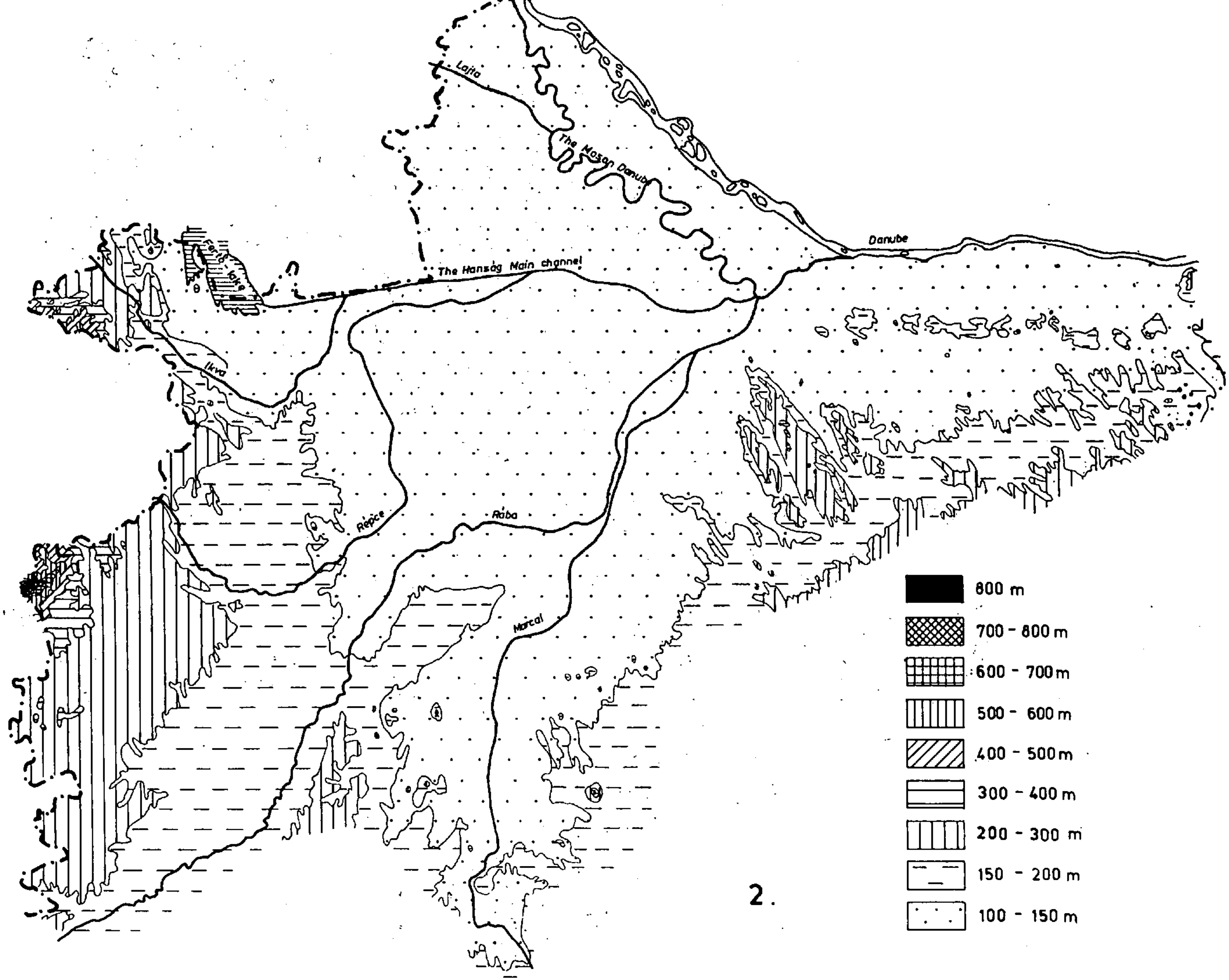
Only one satellite-photo covering the whole Hungarian area of the Kis-Alföld does not exist, because mainly the east-west extension of the region surpasses the scope of cameras of the LANDSAT. So we chose photos made during the time of cloudless atmospheric conditions with a comparatively low vapour-content, which cover the area practically without clearances mosaic-like, even overlap one another many times. While proscsessing we found the photos of the findings of the LANDSAT—I. made on 1st November 1973; the one of those of the LANDSAT—II. made 23rd August, 1978, and the one of those of the LANDSAT—III. made on 20th May 1979 the most suitable for our purposes. It has to be noted that we could not get the spectrums No. 6. of the LANDSAT—I. photo in 1973, otherwise we interpreted spectrumnegatives and spectrumpositives Nos. 4. 5. 6. 7. from each photo-material and those spectrumcombinations of the integrational variation possibilities the aggravated geological emphasizing ability of which proved during analyzing.

Western pictureborders of the LANDSAT—I. photo in November 1973 are approximately in the line of Rajka—Hegyeshalom—Kapuvár—Vasvár so the whole area of our research territory to the east of this line can be seen in the photo. Eastern pictureborder of the LANDSAT—II photo in August 1978 can be identified with the line of Almásfüzitő—Kocs—Császár, i.e. this photo covers the whole area of the Kis-Alföld to the west of this line.

Practically it is the same with the LANDSAT—III-photo in May 1979, the eastern pictureborders of which almost coincide with the edge of the analyzed satellite-photo of LANDSAT—II (this is the line of Szőny—Vértesképhely) i.e. the photo includes the whole area of the Kis-Alföld to the west of this line. Otherwise the area-covering of the used photos is shown on the sketch-map of fig. 1. in a global form, too.

It can be judged by fig. 1. that photo-materials taken at different times of the most important central regions are available in several (three-times) overlappings of the Kis-Alföld. This is a very favourable condition because in this way the regional significancies — made stressed by the different exposure angles of the different satellite-photos and the vegetation characteristics of the exposure-seasons of these or by other reasons—can be controlled in direct comparison with one another, i.e. interpretation becomes easier and more reliable. The importance of the fact must be

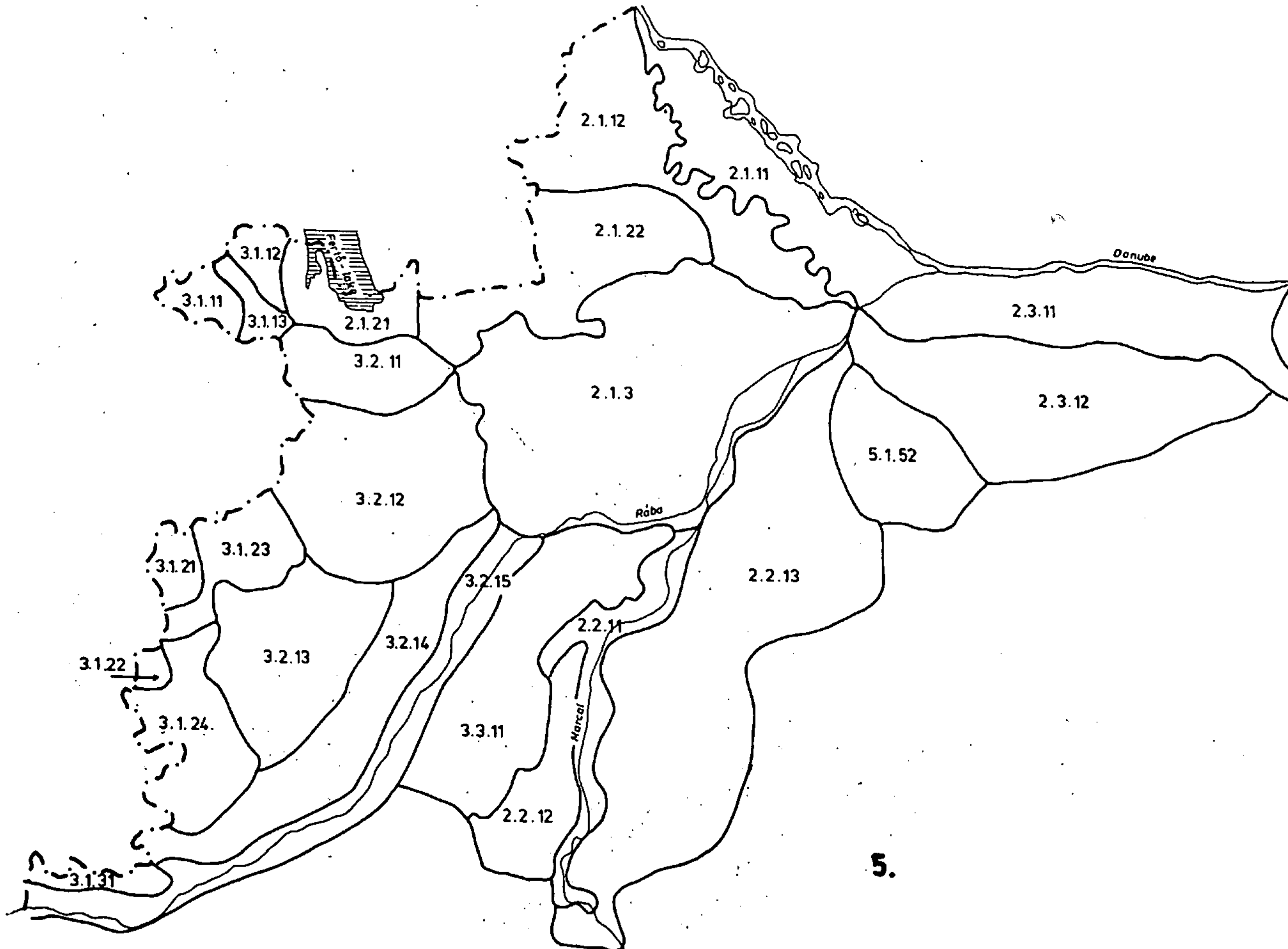
2. The general surfacerelief map of the Kis-Alföld (based on the data Chartography Company)


Lajta
The Mosan Danub
Danube
The Hanság Main channel
Ikva
Répce
Rába
Marcal
800 m
700 - 800 m
600 - 700 m
500 - 600 m
400 - 500 m
300 - 400 m
200 - 300 m
150 - 200 m
100 - 150 m

2.

3.

4. Recens riversystem of Kis-Alföld (data of Chartography Comp. (1974)


2.1.12
2.1.11
Danube
2.1.22
3.1.12
3.1.11
3.1.13
2.1.21
2.3.11
3.2.11
2.1.3
2.3.12
5.1.52
3.2.12
Rába
3.1.23
3.1.21
2.2.13
3.2.15
2.2.11
3.1.22
3.2.13
3.2.14
Marcal
3.1.24.
3.3.11
2.2.12
3.1.31

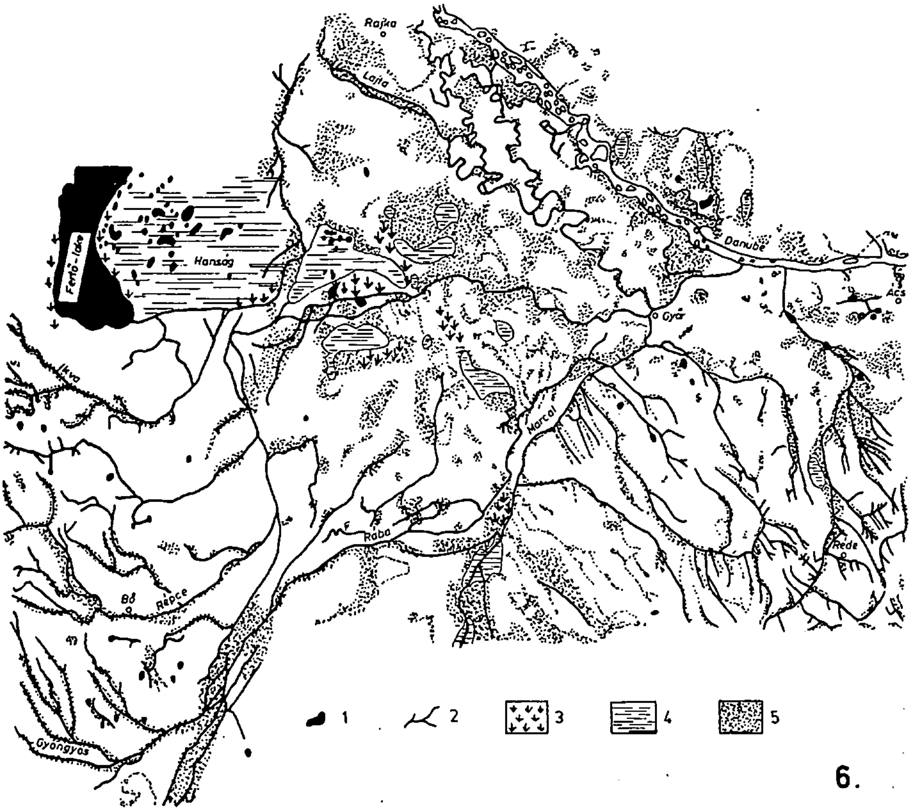
5.

stressed that the photos of LANDSAT—I were taken at the beginning of November so in a season without vegetation, while[1]the photos of LANDSAT—II at the end of August show the "stubble-condition" after the main hervesting, but on the other hand LANDSAT—III took its photos at the end of May i.e. in the season of the green vegetation of the agricultural territories. So by means of comparing these three photomaterials an opportunity presents itself to separate the picturesigns of the cultivated plains mainly on the lowland agricultural territories and in this way to raise the geologically most important petrographical, geotectonical and hydrogeographical real pictureimmanencies under optimal conditions.

While analyzing we kept in view the governing principles of the most favourable usability of the wavebands used with the LANDSAT-system at the Kis-Alföld research-phase, too. That is we paid attention mainly to the signs of spectrum No. 5 informing on wave-length 6000—7000 Å and spectrum No. 7 on wave-length 8000—11,000 Å. It is known that spectrum No. 5 (red) is the main separator of the topographical formations and the vegetation and the antropogen establishments, while spectrum No. 7 (infra-red) makes it possible to registerthe differences in temperature, reveals e.g. the different warming-up and exothermal characteristics of different rocks, the so-called specific heat-characteristics and the built-up and the high moisture contented areas e.t.c.

5. Areal distribution of Kis-Alföld (based on the data M. Pécsi and S. Somogyi, 1980)

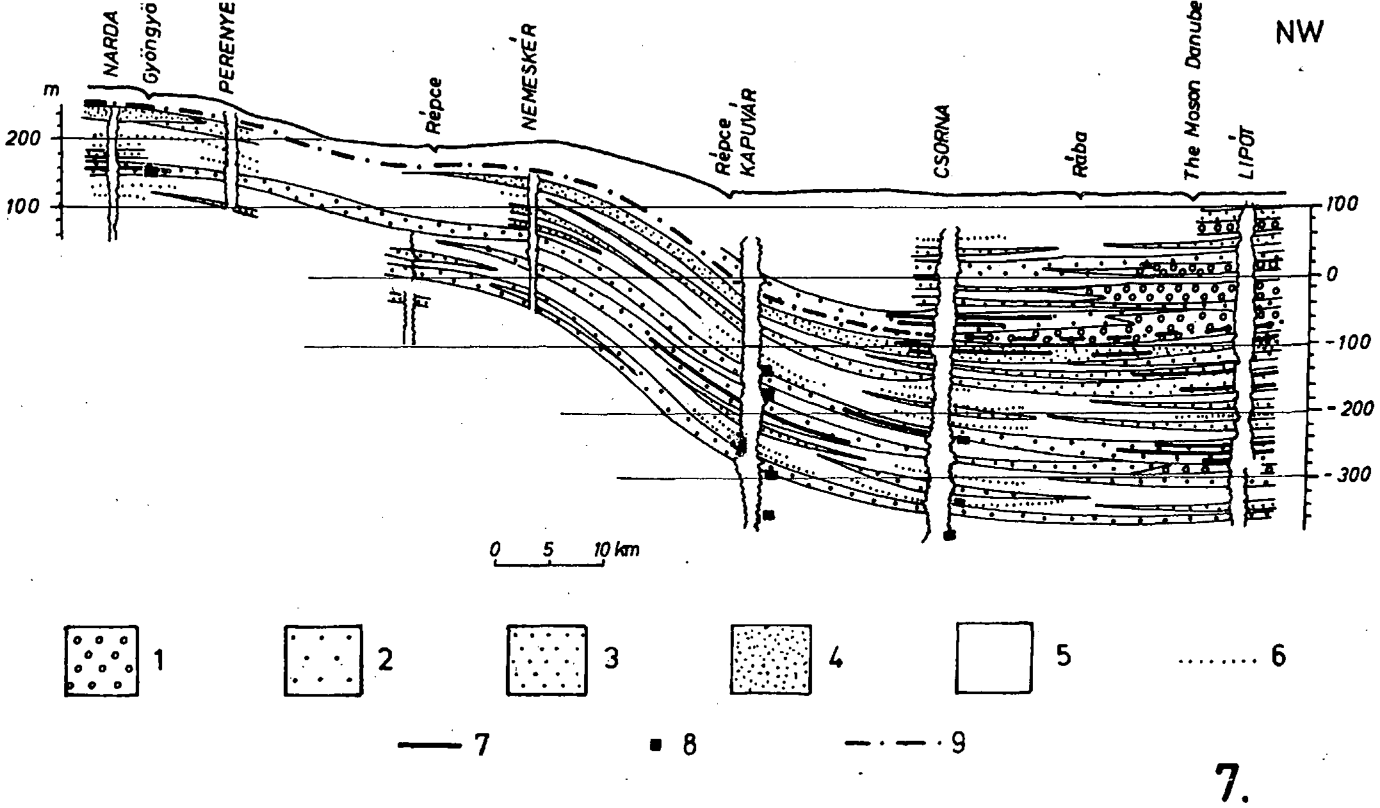
Small areas	*Groups of small areas*	*Midarea*
2.1.11. Szigetköz	Szigetköz—Moson-Plain	The Győr basin
2.1.12. The Moson plain		
2.1.21. The Fertő basin	Fertő—Hanság-basin	
2.1.22. Hanság		
2.1.3.	Inter—Rába territory	The Marcal basin
2.2.11. Marcal-valley		
2.2.12. The bottom of Kemenes mountain		
2.2.13. The Pápa—Devecser Plain		
2.3.11. The Győr—Tata terrace region		(Parts of) the Komárom—Esztergom Plain
2.3.12. The Igmánd—Kisbér basin		
3.1.11. The Sopron-mountains	The Sopron mountains	The foot of the Alps
3.1.12. The Fertő region hills		
3.1.13. The Sopron basin		
3.1.21. The Kőszeg-mountains	The Kőszeg mountains—Vas mountain	
3.1.22. The Vas mountain		
3.1.23. The bottom of Kőszeg mountain		
3.1.24. The Pinka Plateau		
3.1.31. Lower Őrség		
3.2.11. Ikva-plain		The Sopron—Vas Plain
3.2.12. Répce-plain		
3.2.13. Gyöngyös-plain		
3.2.14. The Rába terrace plain		
3.2.15. Rába-valley		
3.3.11. The Upper Kemeneshát		The Kemeneshát (parts)
5.1.52. The Pannonhalma hills-Bakonyfoot (parts)		The Bakony territory (parts)



6. Paleohydrographical map of Kis-Alföld (based on the data of the first military surveying in 1764—1787)

1. lake
2. river
7. Swamp, marsch
4. periodically flooded areas
5. flood-covered alluvial territories

Naturally it results from this in the aspects of the Kis-Alföld, too, an abundace of different geologically valuable referencies is given at different ratios not only by the photos taken at different times but the different bandfindings of the same photo as well. E.g. while the hydrogeographical and petrographical information values of spectrum No. 5 in November findings are very high and spectrum No. 7 of the same photo is almost valueless from this point of view, hydrogeological and geological information of LANDSAT—II photo in August tells more than spectrum No. 5 of the same photo. With the photos in May, however, the wanted geological immanencies stand out to the highest pitch in the photos taken in spectrum No. 6.



7. SW—NE sedimentfaciological section of Kis-Alföld between Narda and Lipót
(based on the data of J. Urbancsek)

1. pebble, pebble with sand, sand with pebble
2. middle and big-size sand
3. middle and small-size sand
4. fine grained sand with rock middlings
5. rock middlings, mud, clay
6. less than 3 m-thick sand interbedding in a clay layer
7. less than 3 m thick rock middlings, mud and clay interbedding in sand
8. lignite interbedding
8. border of upper Pannonian, upper Pliocene and Quaternary layers

Six of our documents of analyzis marked in the table are shown on photosupplements. The geological reference maps elaborated in the inrtepretation are shown on separated figures The metodological principle of the research was to project the white lined signsystem of the negatives taken of the maps directly on the satellite-photos. The signsystem had an exactly fitted scale. If we did not do it in a darkroom but in a halfdarkroom the details of the satellite-photos and those of the projected lined informationsystem could be seen at the same time perfectly. The practicality of the method can be increased by that we can block out the projected sign at intervals for periods according to choice then block back. So it will be possible to exactly identify the lineaments coincidental in some places and the areas with exposures interfering one another.

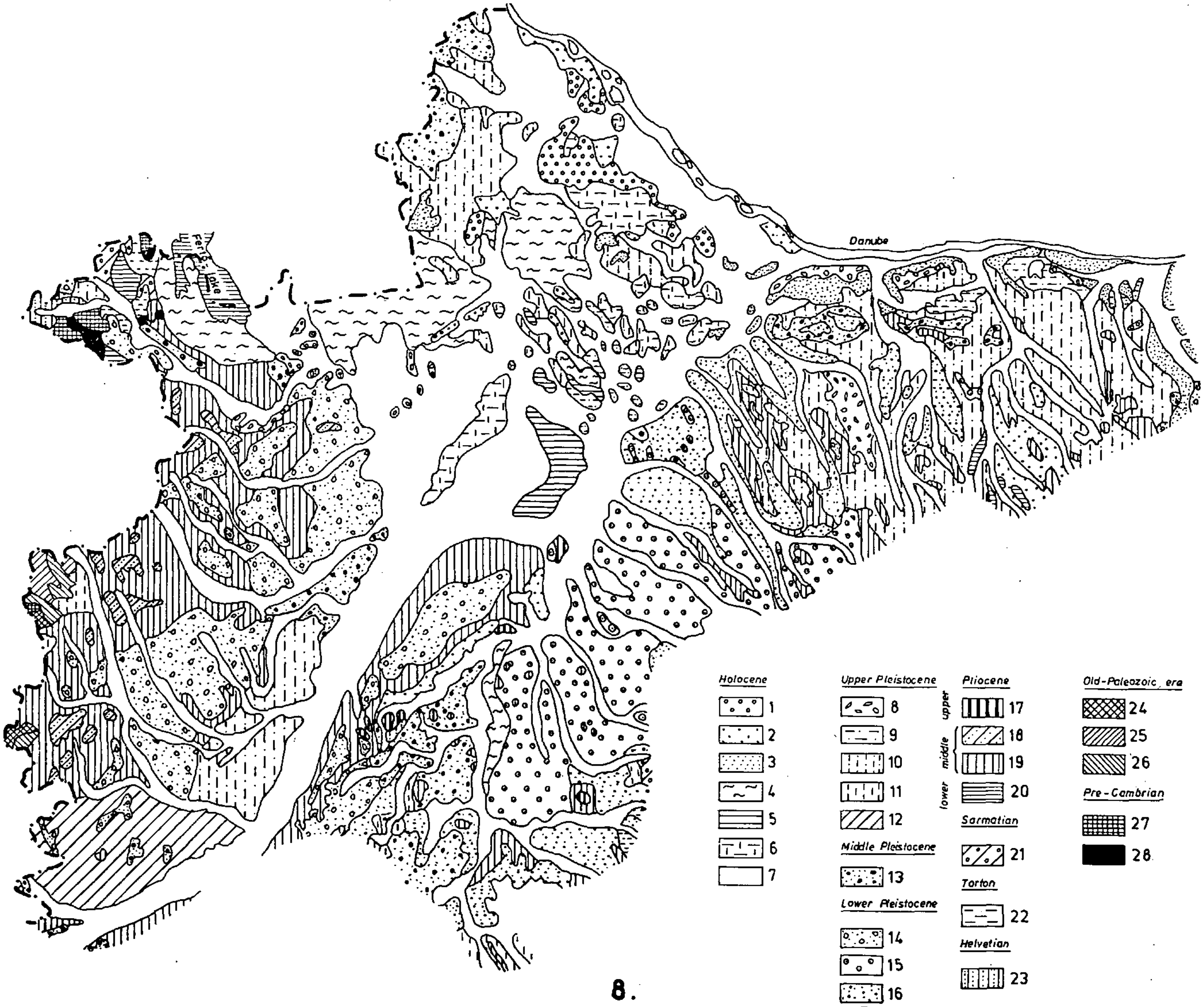
Conclusions

1. The LANDSAT-photos compared with the detailed surfacerelief map constructed of the area (see fig. 3) prove that there are no morphological and relief region borders and differences in region features between Sopron—Was-lowland, Felső-kemeneshát and Marcal-valley (belongs already to Kis-Alföld according to the region-categories accepted today), Kemenesalja and Pápa—Devecser lowland (Marcal-basin. What is more, according to the relieflogics of the region Sopron—Vas-lowland connects to the Győr-basin closerly than to Marcal-basin with a little more broken surface and showing more restless reliefrelations.

On the basis of the geological and basinstructural fundamentals we got to the same conclusion. So geomorphologists' (Góczán, Somogyi) point of view about regionalcategorization that the Sopron—Vas-lowland is not part of the Kis-Alföld after all but part of the macroregion Western-Hungarian-perifery is accounted only by other, not geological and not geomorphological regioncategorizing factors (subalpian- subatlantic climate effects, special botanical, soilgeological and waterbalance relations). But since from the satellite-photos taken of the Kis-Alföld we wished to investigate geographical (geological, crustal structural, surfacedinamical and geomorphogenetical) immanencies and areal connections, naturally we could be pleased with the limiting physical geographical macroregion-borders in our elaboration, but as far as possible we made an effort to a more complex areal reseach of the structurally organic more extended Kis-Alföld basinstructure.

2. LANDSAT-photos prove it clearly that the Kis-Alföld is a lowland the surface of which was made plain by accumulation mainly of riversediments and this accumulating progression with dinamics and thickness of layers different by parts of area shows a geologically permanent siltation with differences in siltationintensity area by area up to the time of rivercontrols. But there are areas of the Kis-Alföld that are not in the condition of siltation but in that of surface washaway and this can be seen in the long distance survaillances. The recens regiongenetical factor of these areas are first of all areal erosion derasion and in a lesser part deflation and fluvial erosion, and naturally in addition to these the different effects of antropogen regiondeveloping get a role, too.[1]

The main area of the recens fluvial and areal washaway is the terraces of the rivers as well as the area to the east of the Rába-line, while to the west of the Rába we have to place only those areas with greater reliefenergy belonging to the Western-Hungarian-perifery, which do not coincide with the area of recens alluvial cone of



8.

8. Petrogeological map of the surface formation of Kis-Alföld
ö (based on the data of MÁFI)

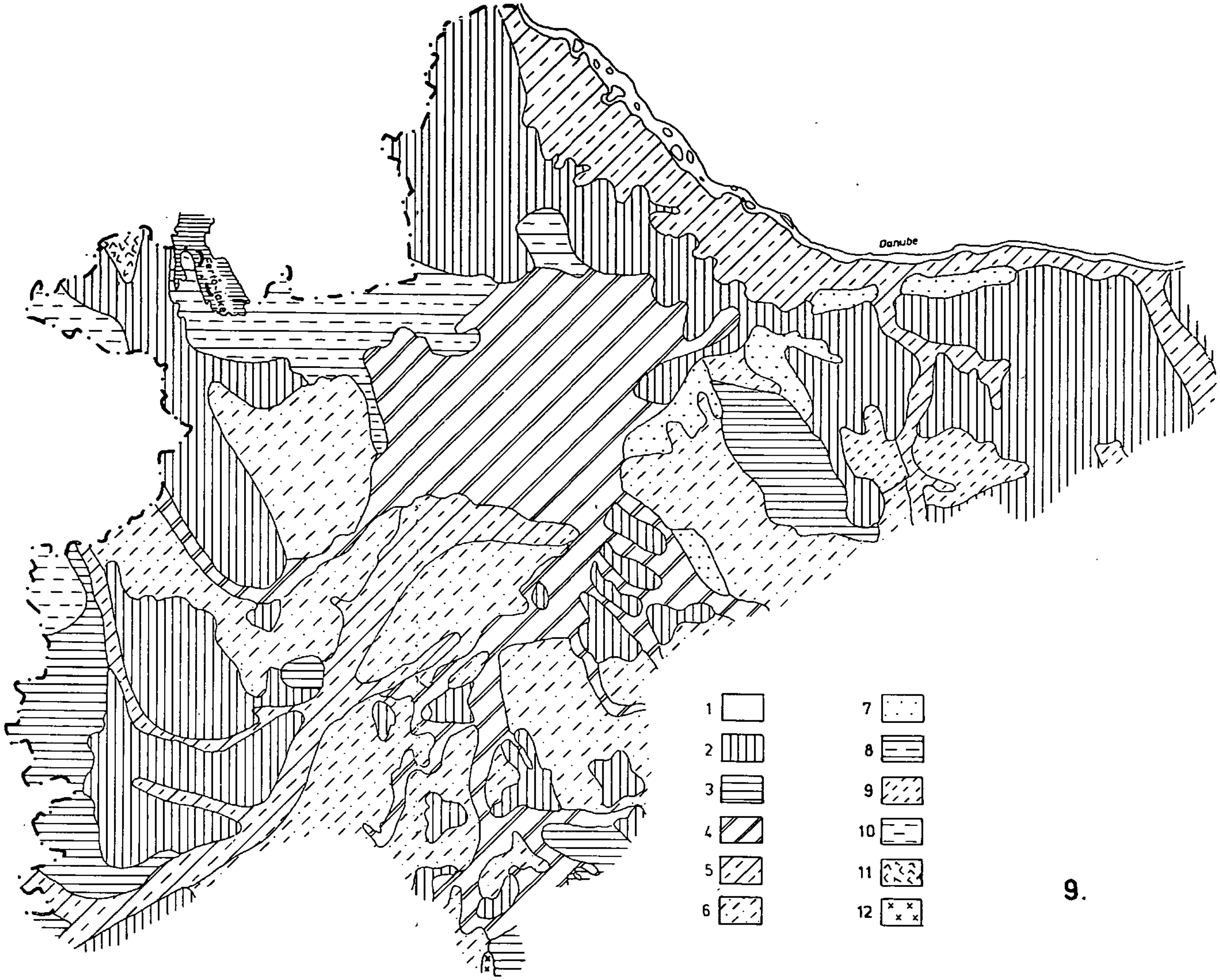
Holocene
1. fluvial pebble
2. fluvial sand
3. wind-blown sand, hard sand
4. peat, peat-mud
5. meadow clay
6. silt with loess
7. flood-sand-mud-clay

Pliocene
lower-middle-upper
Pliocene
17. basaltic tuff
18. sand, sandstone, travertin
19. clay, sand, brown coal deposit
20. sand, clay, pebble
Sarmation
21. pebble, sand, clay
Torton
22. "Lajta" limestone, sand, clay
Helvetian
23. conglomerate pebble, sand

Upper Pleistocene
8. pebble
9. fluvial sand
10. loess with sand sand with loess
11. loess, ochre
12. brown and bole ground

Middle Pleistocene
13. pebble
14. pebble with sand
15. pebble
16. sand

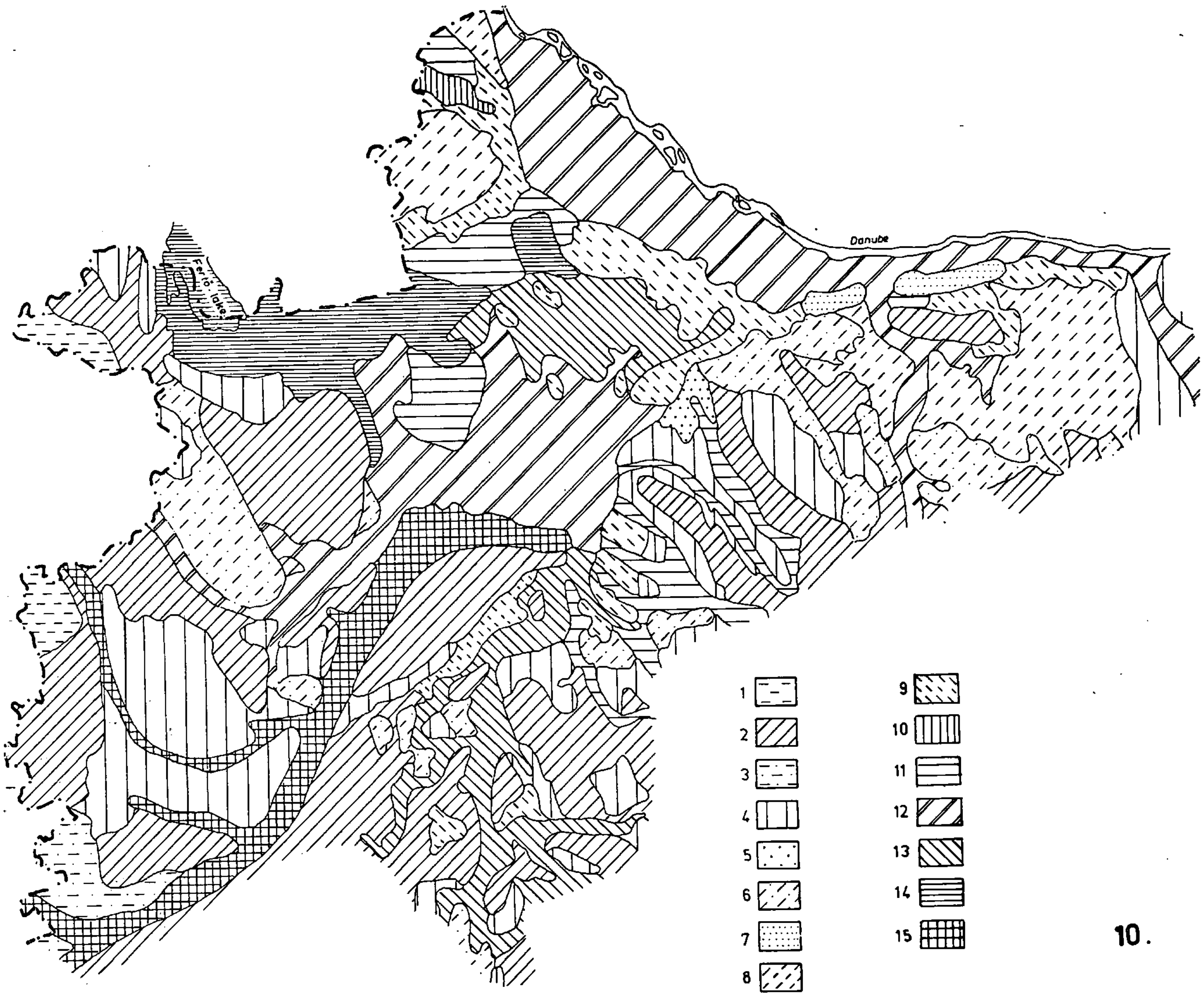
Old-Paleozoic era
24. green-shale
25. quarz-mica-shale
26. lime-mica-shale
Pre-Cambrian
27. mica-shale, quarz, leukofillit
28. gneiss



9.

9. Lithofacies map of the surface formation of Kis-Alföld
(after P. Stefanovits and L. Szűcs)

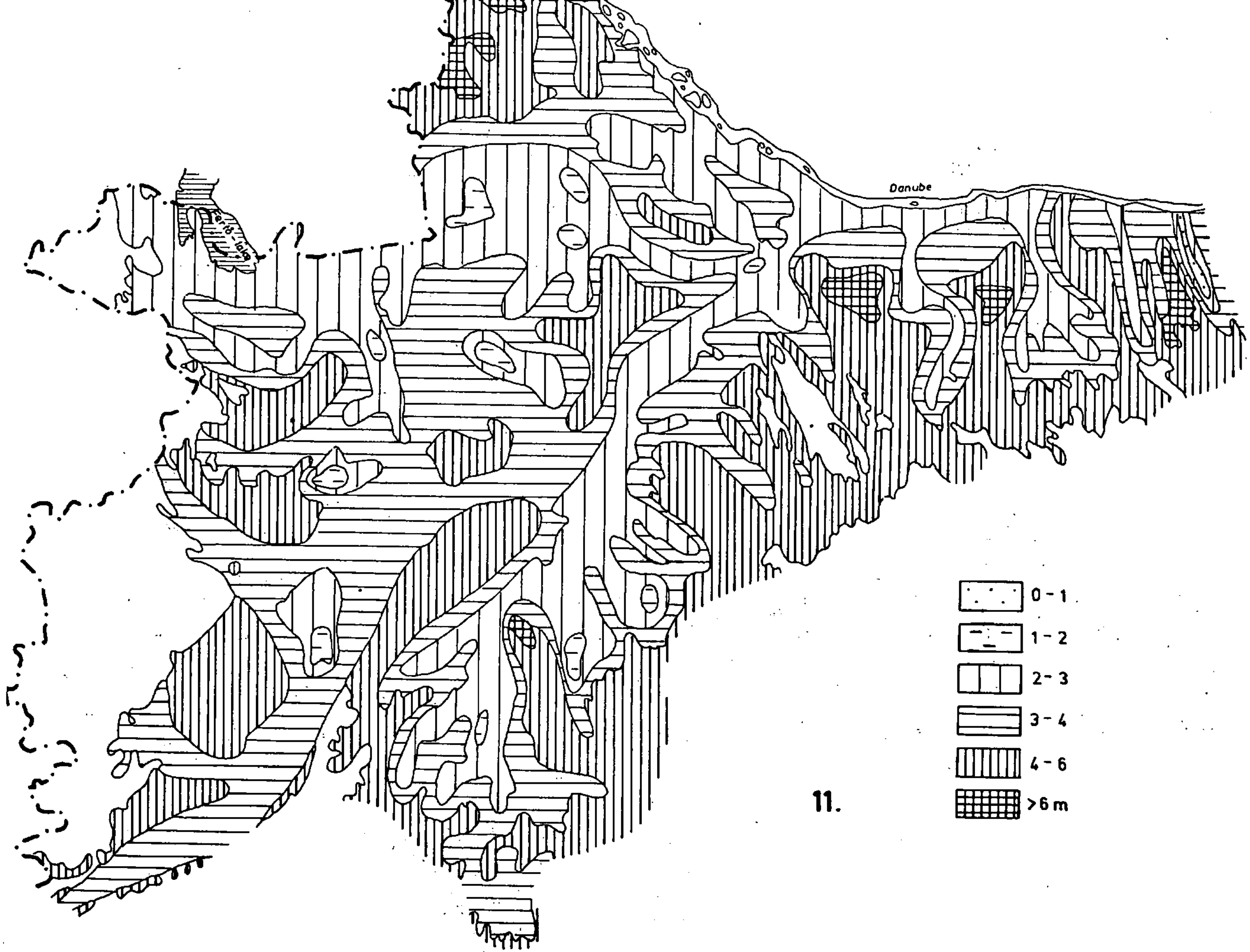
1. clay and adobe with clay, loess deposits
2. middlehard adobe, loess deposits
3. middlehard adobe, tertiary and older deposits
4. clay and adobe with clay, glacial and lacustrine or alluvial deposits
5. middlehard adobe, glacial and lacustrine or alluvial deposits
6. adobe with sand, glacial and lacustrine or alluvial deposits
7. sandy glacial and lacustrine or alluvial deposits
8. organic glacial and lacustrine or alluvial deposits
9. adobe with sand and with loess deposits
10. argillite, fillite
11. limestone, dolomite
12. andesite, rhyolite, basalt



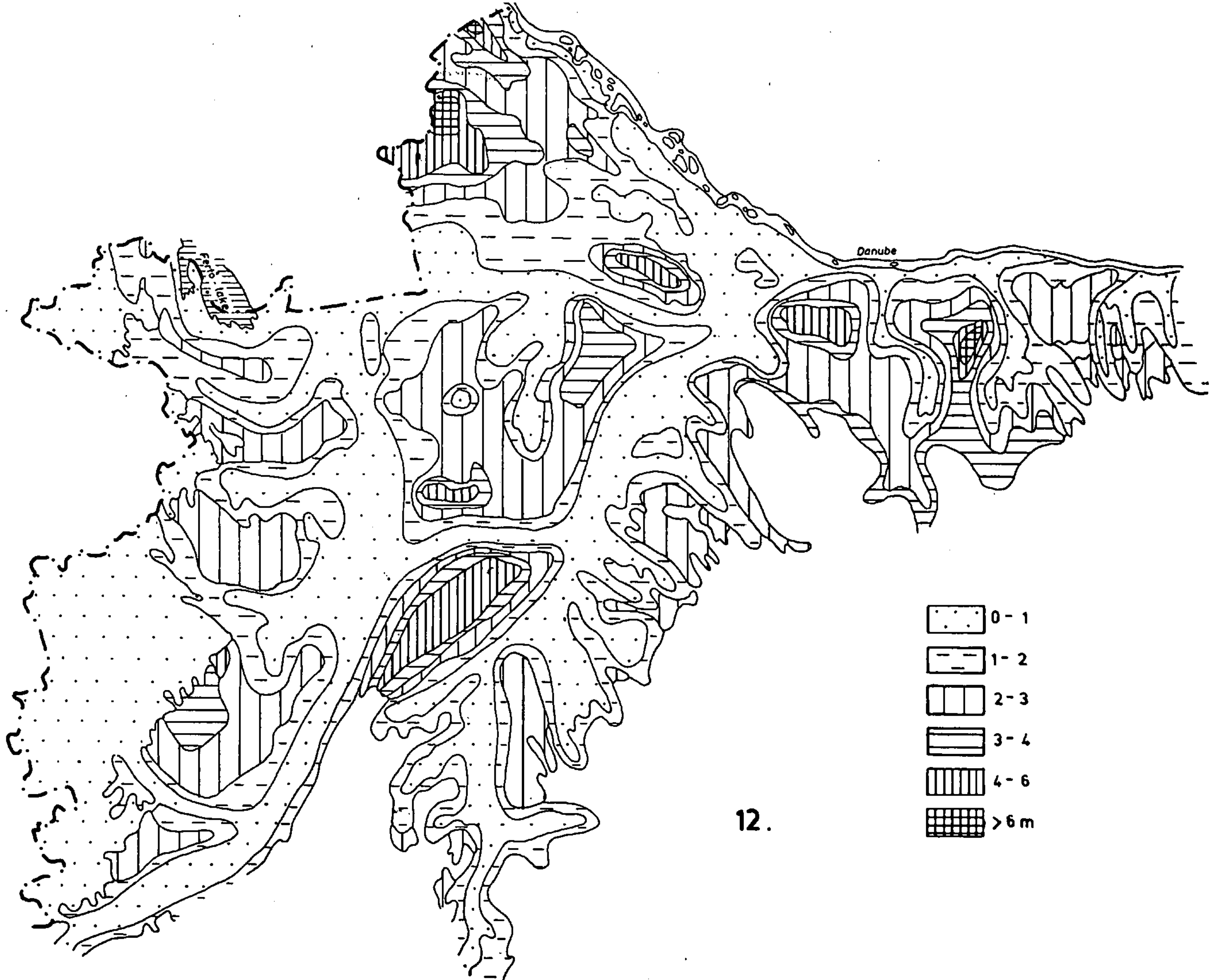
10.

10. Genetical soil map of Kis-Alföld
(based on the data of P. Stefanovits and L. Szűcs)

1. strongly acetons, non-podsolic brown forest soil
2. podsolic brown forest soil
3. brown forest soil with pseudogley
4. brown soil,
   The Ramann krown forest soil
5. brown forest soil with
6. blackearth brown forest soil
7. blackearth-like sand
8. typical blackearth with limefur
9. meadow blackearth
10. glood blackearth
11. meadow soil
12. meadow flood soil
13. marshy meadow soil
14. reclaimed sodic marshy soil divided into lots
15. fresh floody soil



11. The observed deepest position of underground water level in Kis-Alföld (based on the data of VITUKI)



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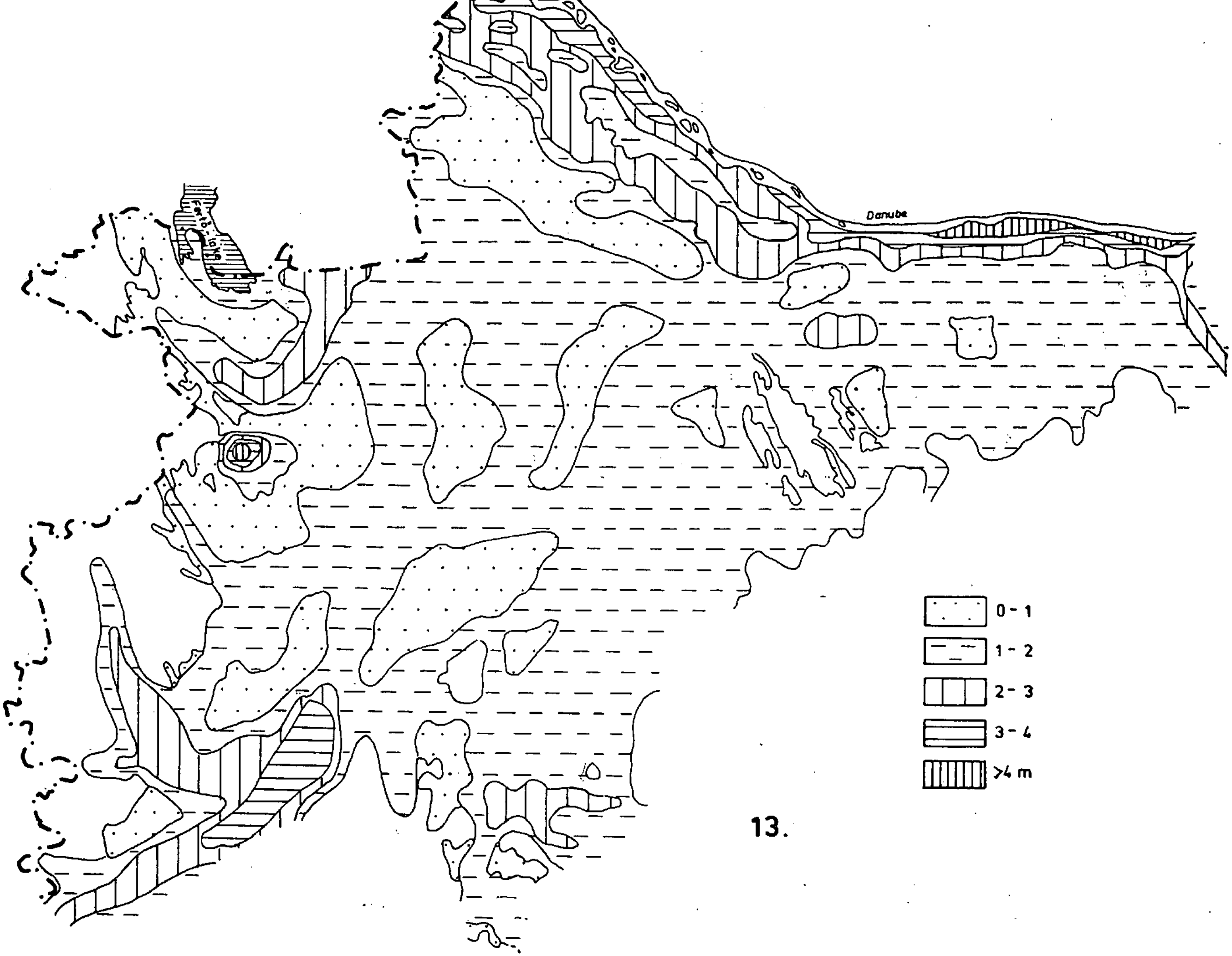


13. The observed highest position of water level on Kis-Alföld (based on the data of VITUKI)

some rivers (see fig. 28.). Naturally agriculturally and pedologically the soilerosion regions are not geomorphological regiongenetical categories and these should be judged from another angle for the soileluvational or other soildestructional progresses can go on in parts of regions a-building geomorphologically (compare with fig. 14).

In addition to the building (siltation) and destructing (washingaway) types of region (the two regiongenetical extremes) the satellite-photos show neutral regions as well which have to be considered as sinking area uncompensated by recens accumulation as compared to the informations of traditional channels. It has to be noted that the area of this transitory regiongenetical category on the Kis-Alföld has increased suddenly since the rivercontrols in particular at the expense of the building areas. But in our map. 28. we marked this regioncategory only there where its geomorphological and other regioncharacteristics are reflected on the [1]satellite-photos (piecelandborders without directiontendencies, the lack of natural water-courses e.t.c.).

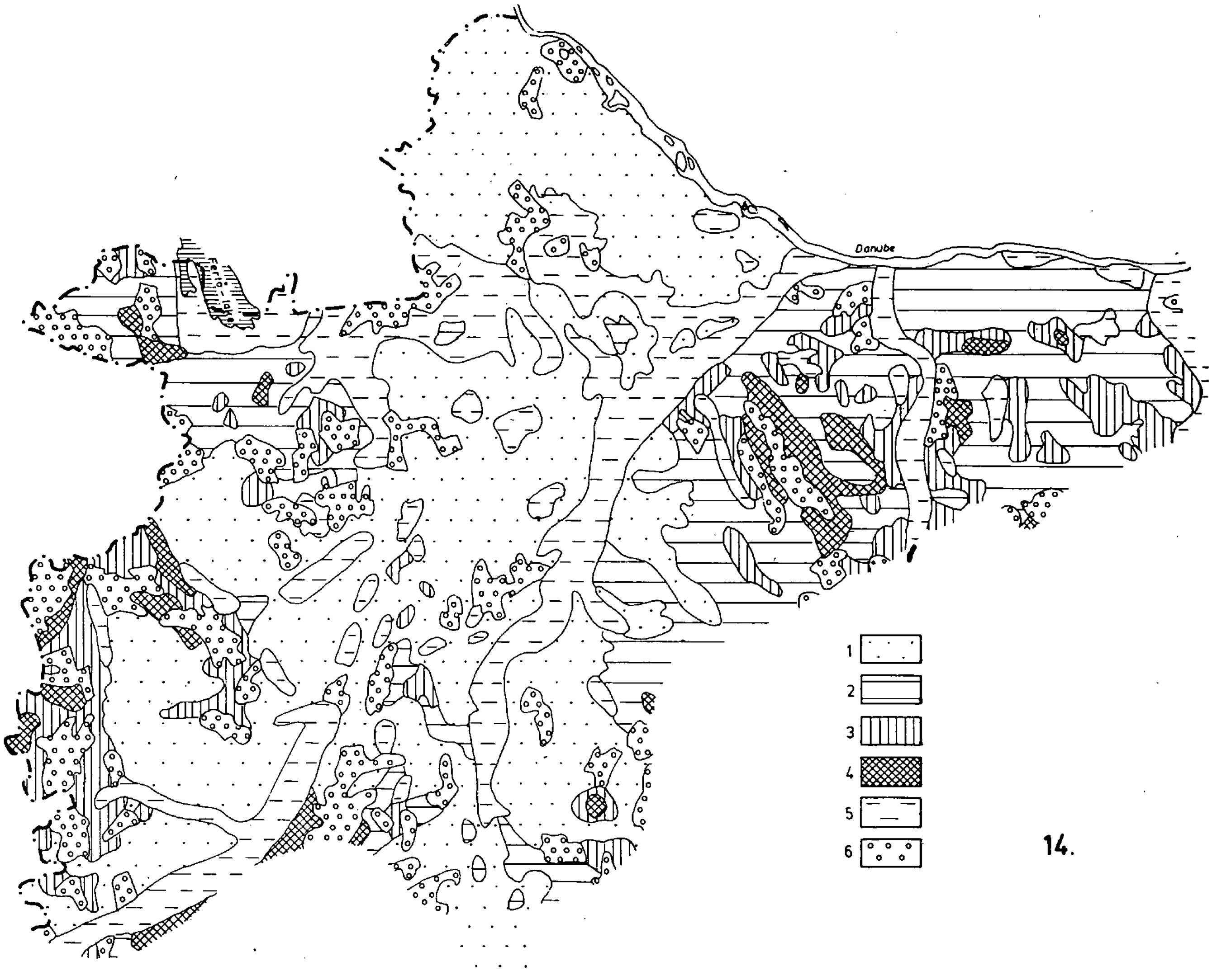
3. Most of the sediments filling thickly the sinking basin of Kis-Alföld is fluvial deposit in particular with facies of typical alluvial deposit consisting of gravel, sand and clay. The filling up of the middle of the basin is a deposit mainly of Danubian origin.

The tibutaries arriving to the edges of the Kis-Alföld separately built up their alluvial cone and the material of these can be separated from that of the Danube (Szádeczky-Kardoss, M. Pécsi, L. Ádám). Because of the slightly bulging alluvial cone of the Danube the tributaries (Rába, Répce, Marcal) did not previously carry their gravel sediments inside the basin either. (see figs. 18. 19.) The borders of the alluvial cone systems belonging to different rivers are shown on the satellitephotos and these findings entirely affirm the mineralogically drawn regionborders.

Long distance survaillances prove in all aspect the opinion fixed in the technical literature (Szádeczky-Kardoss, M. Pécsi) that the southern part of Kis-Alföld got a thick coarse layer at the beginning of the Pleistocene (i.e. it became a collecting area of coarse sediments from mountainedge). Later with the water-shed areas becoming rainier (interglacials) this was excavated and abradaed by the slitting rivers,

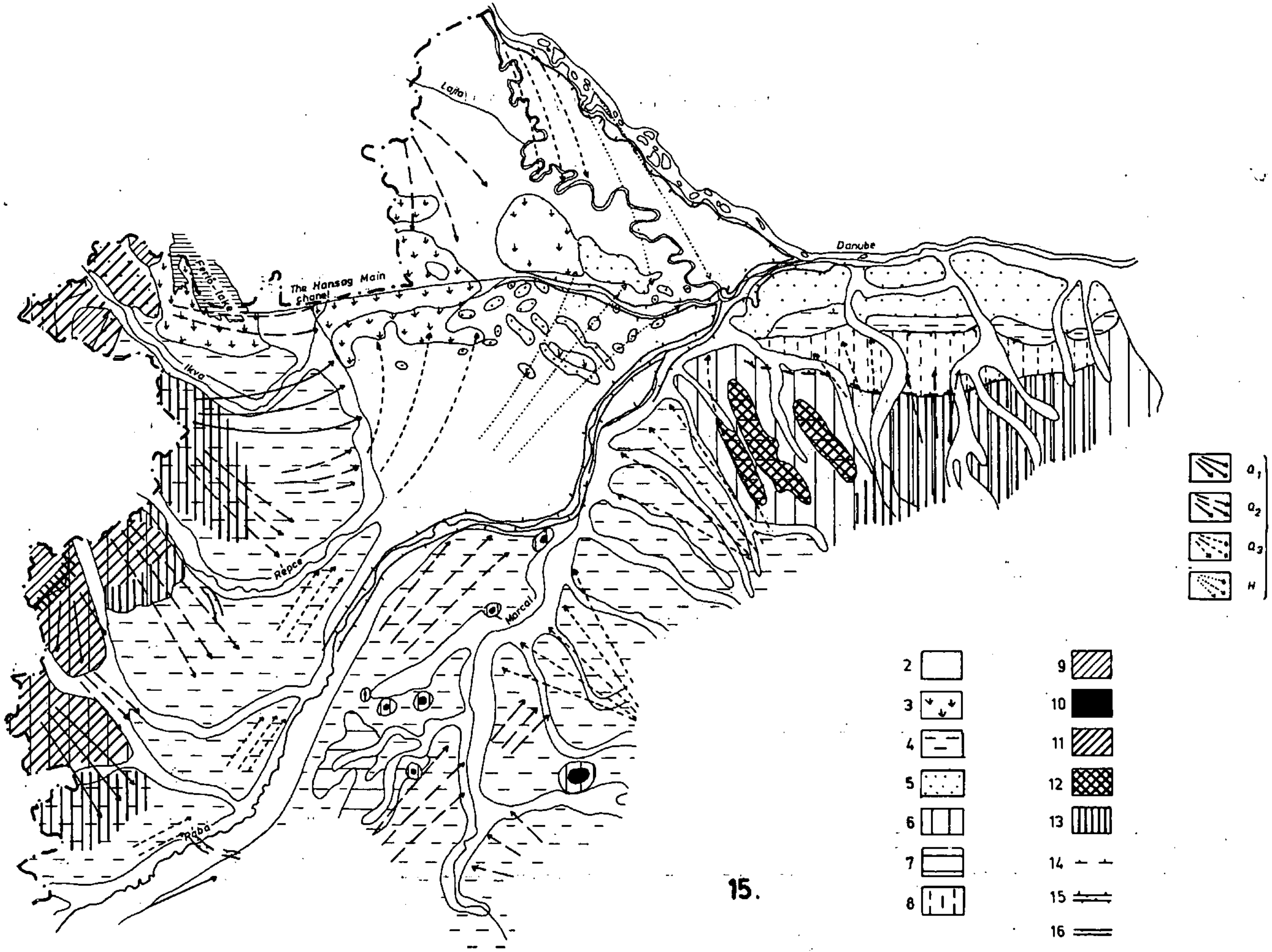
15. Geomorphological map of the Kis-Alföld (after M. Pécsi, 1972)

1. alluvial cone
2. high tide-lands
3. low tide-lands
4. alluvial cone plain with terrace
5. alluvial cone plain covered by sand and loess
6. hang of hills
7. ridge of hills
8. intermountain small basins
9. ruptured block-mountains from the ancient times
10. vulcanic mountain
11. slightly indented mountain foot, foremountain slope
12. former mountain foot densely indented by valleys
13. lower hills indented by erosion and derasion valleys
14. denudation basin
15. riverbanks
16. far-reaching cutting



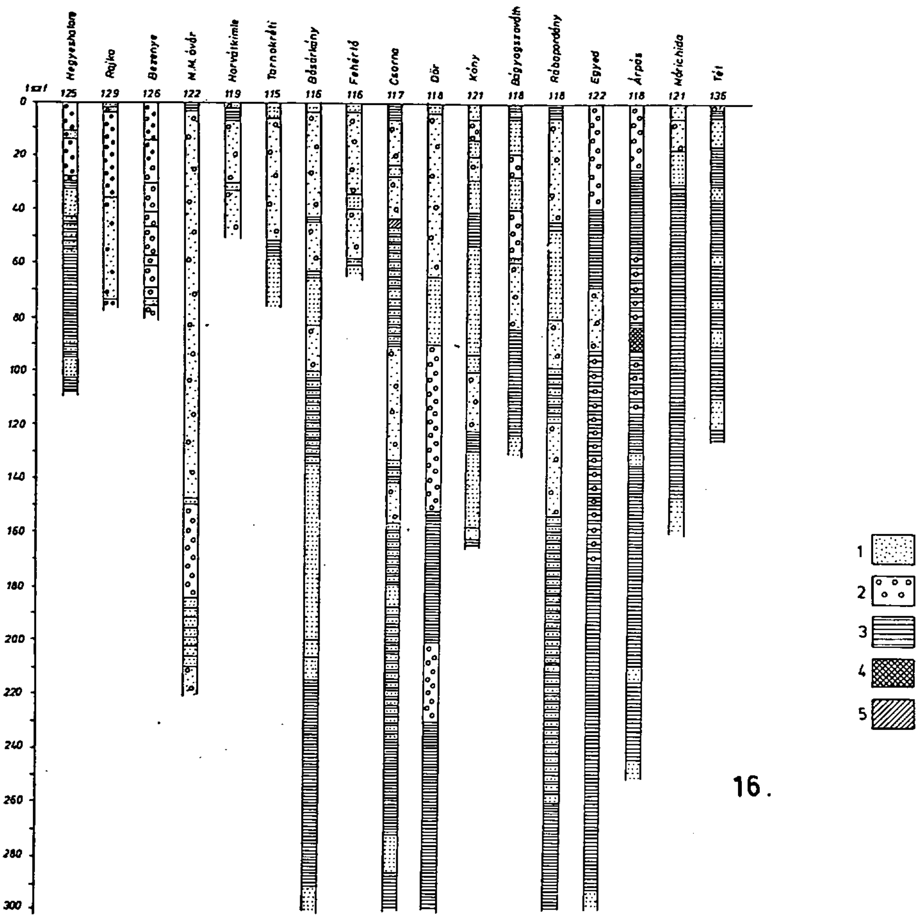
14. Areas of the Kis-Alföld potentially endangered by soilererosion (based on the data of T. Duck and P. Stefanovits)

1. non eroded or little-eroded territory
2. slight erosion (less than 30% damage of the original surface soil)
3. middle-sized erosion (30—70% of the original surface soil is eroded)
4. serious erosion (more than 70% of the original surface soil is eroded)
5. the accumulation area of washed-away soil
6. forest



Lajta
Danube
The Hansag Main chanel
Fertő lake
Ikva
Répce
Rába
Marcal
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
a_1
a_2
a_3
H

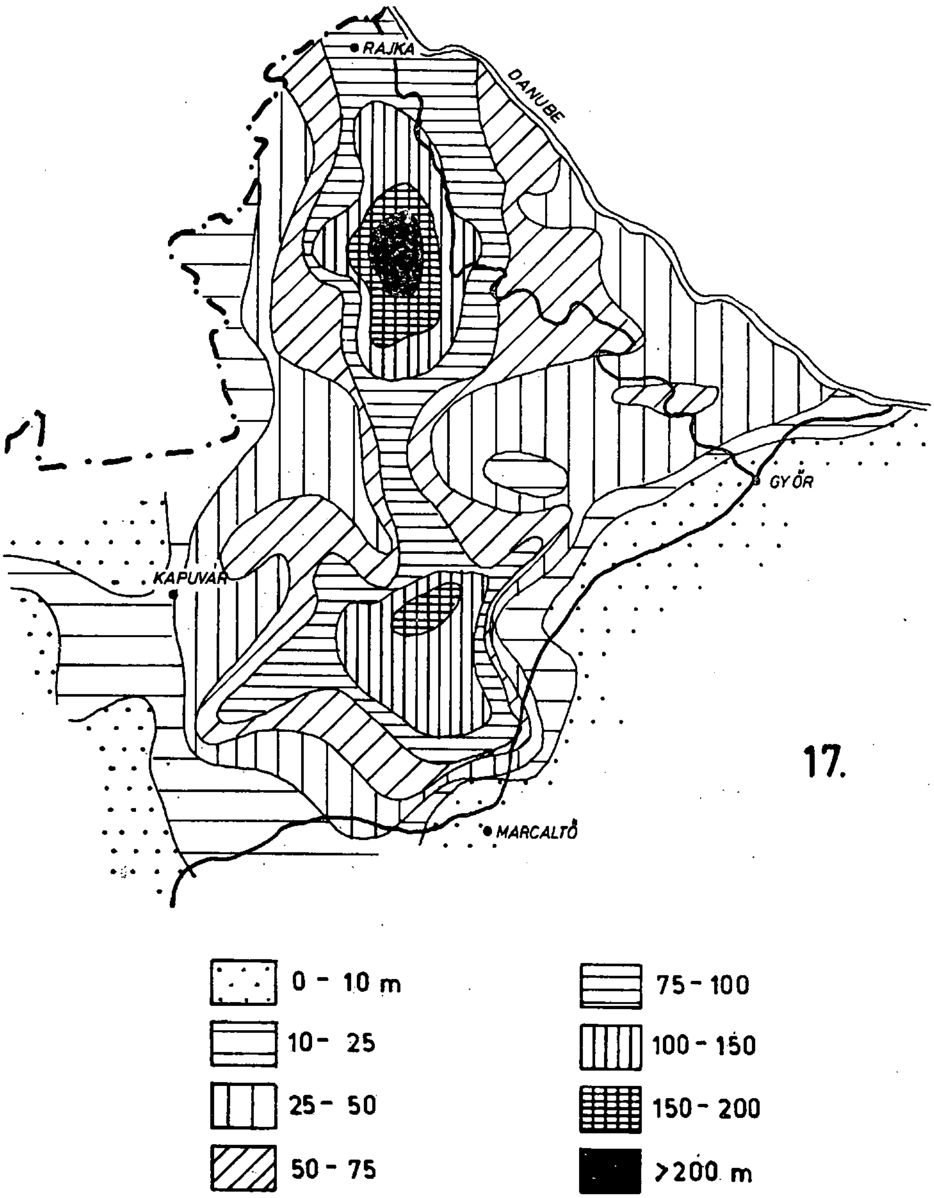
15.



16. The layers of some artesian well of the Kis-Alföld on the NW—SE section (based on the data of A. Rónai)

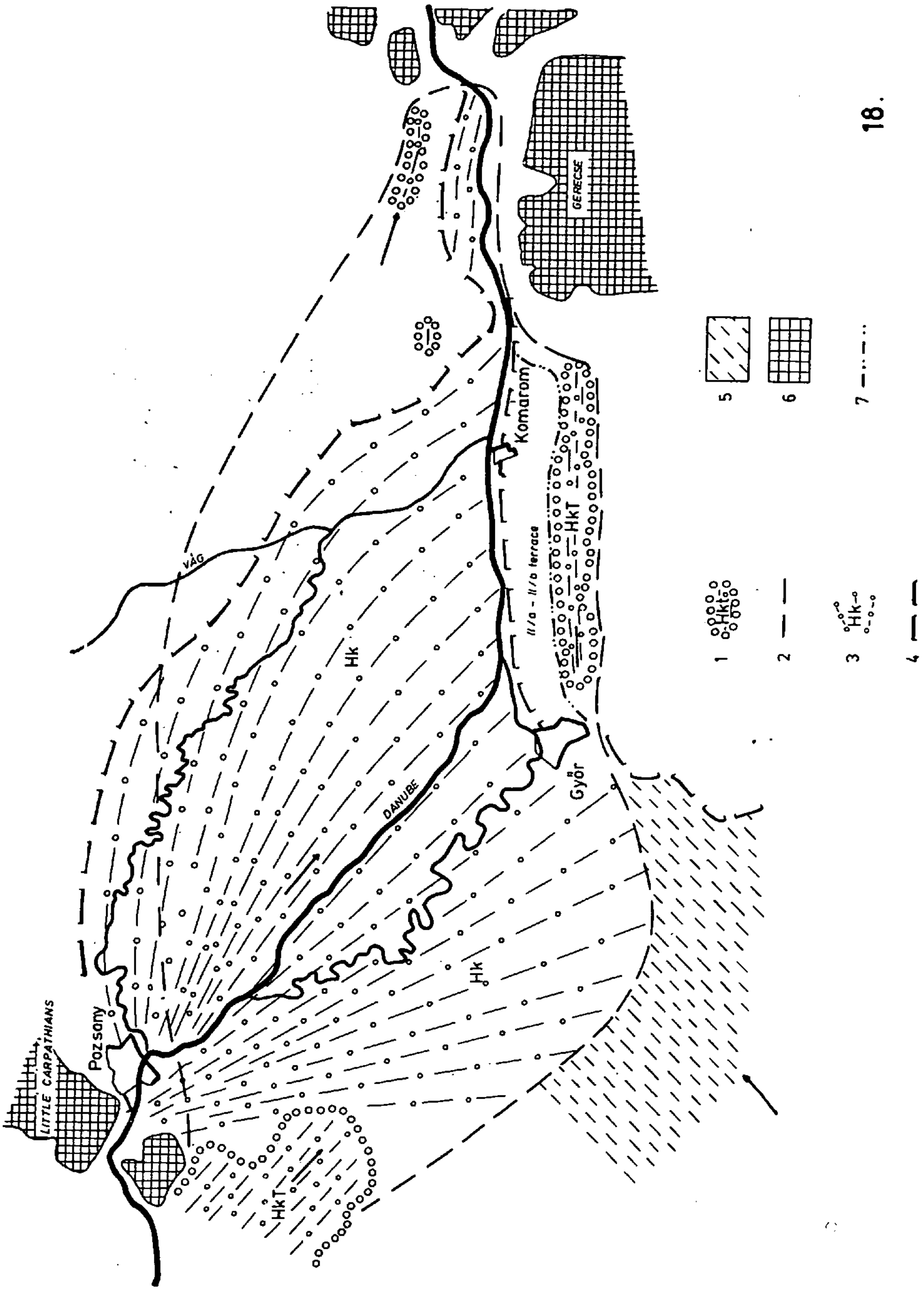
1. sand
2. pebble
3. clay
4. sandstone
5. tuff

or their sedimennts got to the deep in the central parts of the basins during the basin-sinking, became covered by younger sediments so their remains can be found on the surface mainly only at the edges of the plain as e.g. high terraces (see fig. 7.) But the characteristics of the terraced basinedge alluvial cone plains reflecting on the LANDSAT-photos do not make it possible to define exactly by parts of areas where the most effective Pleistocene turnover regions of reach characteristics of rivers, that could increase the intensity of erosion to the degree of the whole transforming of permanent tendency of regionbuilding. We can state for certain only on the edge regions



17.

17. Total thickness sand-gravel layers of Kis-Alföld
(after A. Rónai, 1960)


LITTLE CARPATHIANS
Pozsony
VÁG
Hk
DANUBE
Hk
Győr
Komárom
II/a - II/b terrace
HkT
GERECSE
HkT
1 Hkt
2
3 Hk
4
5
6
7

18.

e.g. Pandorfi-plateau, the Marcal-basin and Komárom—Esztergom-plain that most of these terraces lying higher than the floodplains belong to the relieftype of plains that were made by the abrasion of the alluvial cones.

4. The comparison of regions with siltationdinamics markable on the satellite-photos and the informations of areal deepboring strataexaminations show that degree of the sedimentaccumulation different by parts of areas reveals not the different degree of deposit carrying of the rivers first of all but mainly the eustatical levelchanges of the basinbeds specifically different regionally. In other words it means that the regional facies system of the riversediments on the surface of the Kis-Alföld is determined by the negative levelshifts with regionally specifical intensity. This is the only reason for the striking anomaly, that rivers carrying relatively few sediment (e.g. Gyöngyös) accumulated wider and thicker alluvial-cone as compared to the bigger rivers which carry much more sediments than they (e.g. Répce).

5. The comparison of the LANDSAT-photos and the geophysical and deep boring informations concerning the relief basement complex proves that the most important recens confluational regions of the rivers in Kis-Alföld do not coincide with the deepbasin centres, but sometimes they shifted the different distances from them in accordance of the main wash away directions. This is the most striking at the junction of the Danube and its tributaries, for the Danube takes up its right tributaries at Győr and Vének although the sinking center of the Kis-Alföld is approximately 20 km-s far to the west-northwest from here, in the region of Ásványráró (see figs 20. 21. 23.)

The shifting of the left tributaries of the Danube in even larger (approximately 50 km-s) for the river Vág can flow into the Danube only at Komárom.

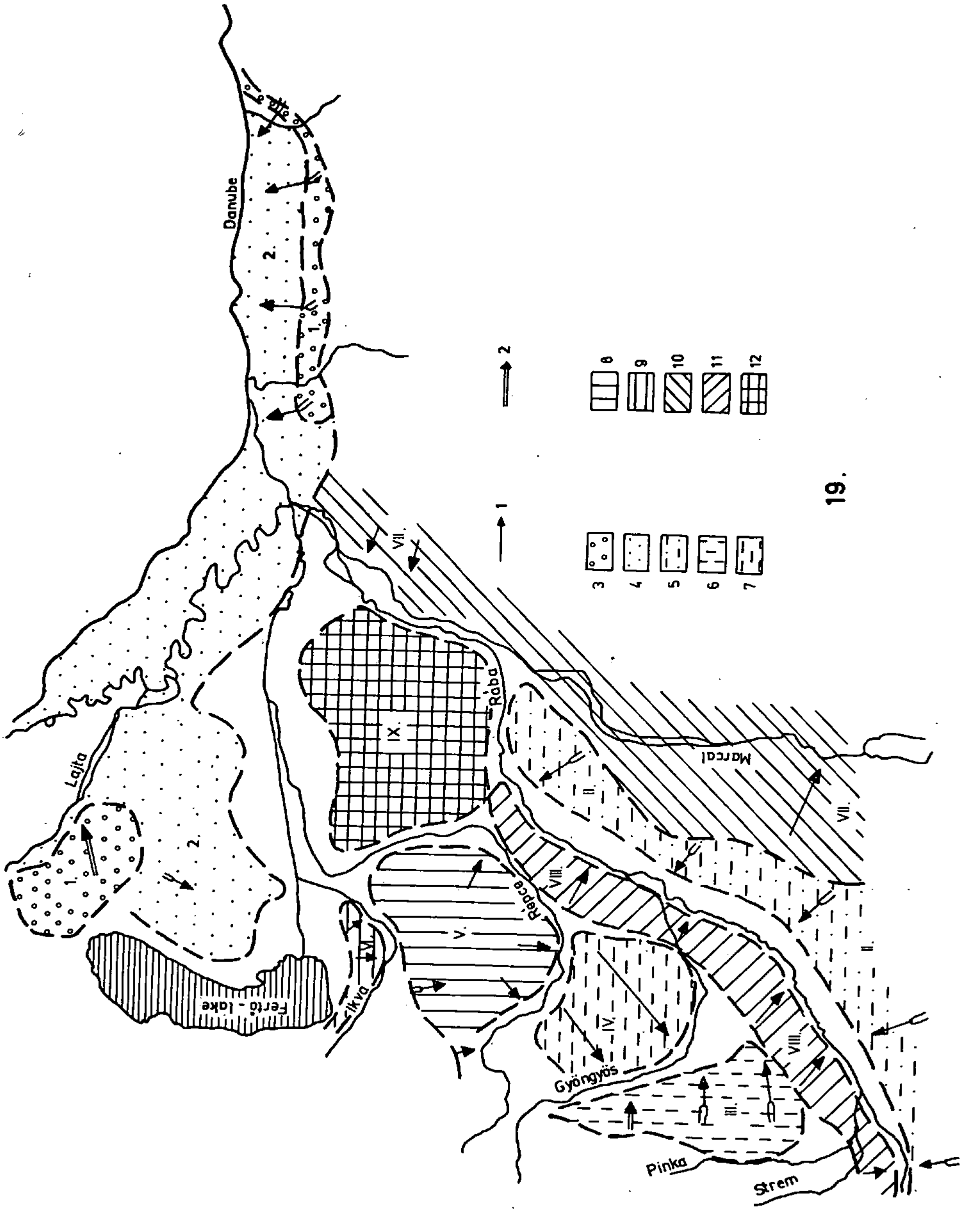
This clearly shows that the fluvial siltation could not only keep step with the sinking of the basin of the Kis-Alföld before the rivercontrols, but accumulation rate had significant reserve possibilities as well.

Of course since the rivercontrols the flood area became much smaller where the river can lay its deposit. The significant role of this fact is in that the Danube flows in the axis of an ellevation built by itself and that its recens alluvial cone is rising with a greater and greater rate.

The levelling results (fig. 27) of L. Bendefy seemingly in contrast with the geotectonical interpretations arise right from this condition, i.e. the recens levelchanges of Kis-Alföld are only the resultants on the one hand of the eustatical levelshifts arising from the sedimentcompactional manifestations, on the other hand of the recens accumulational overcompensations of these.

18. Position of younger and older alluvial cone of the Danube of the Kis-Alföld after M. Pécsi (1962)

1. abided parts of the Danube old alluvial cone
2. the supposed extension of older alluvial cone, created from the beginning of Pleistocene till the end of Mindel
3. surface extension of younger Danube alluvial cone
4. border of younger alluvial cone created from the Mindel-riss interglacial till the present
5. younger alluvial cone of the Rába, Répce and Marcal rivers
6. marginal mountain cones
7. border of II/a, and at places III. terrace between Győr and Komárom


Danube
Lajta
Fertő - lake
Ikva
Rábca
Rába
Marcal
Gyöngyös
Pinka
Strem
1
2
3
4
5
6
7
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10
11
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19.

6. The LANDSAT-photos gave a very good possibility for recognizing the main lineaments basicly defining the structure of the Kis-Alföld. Since these lineaments coincide only partly with the bed-reaches of the rivers, and in some places entirely independent from the riversystem (from the fossil riversystem, too.) but at the same time they are the demarkaters between areas with mostly different regioncharacteristics, we have every reason to regard these linaements as the reflections of real neotectonical lines. The most important lineaments are as follows:

a) *Danube-line* (in the northwest-southeast direction) which coincide with the straight bedline of the Danube between Bratislava and Vének. This is parallel to the.

b) *North-Fertő-lineament,* which can be traced only with difficulty on the area of Hanság and Rábaköz, but it can be followed again in the line of the Sokoroi-Bakony creek on the south-west edges of the Pannonhalma-hillcountry.

c) *South-Fertő-lineament* (west-northwest-east-southeast) runs from Sopron to Petőháza but little to the north of the bed of Ikva. On the basis of the signs on the satellite-photos it seems that this lineament was stressed by the lateral erosion of Paleo-Duna.

d) *Gyöngyös—Perint-line* (north-northwest-south-southeast) between Kőszeg—Szombathely—Rábahídvég which can be traced in the middle of the gravelled alluvial-cone of the Gyöngyös, in the demarkatorline between the lower leftbank gravel-layer and the higher rightbank gravel-layer.

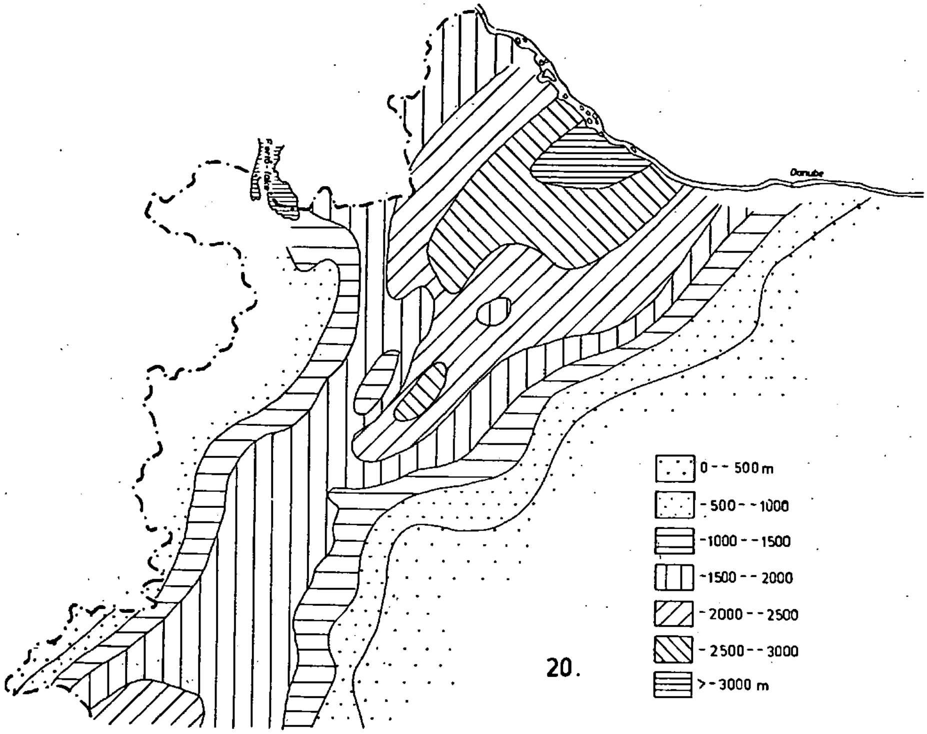
e) *Pannonhalma-lineament* (northwest-southeast) which can be seen on the north-east side of Pannonhalma-hillcountry in the line of Nagybarát—Nyúl—Ravazd. Its tectonical origin is beyond argument).

While the lineaments described in the points a-e roughly harmonize with the transversal structure lines of the Transdanubian mountains, the following lineaments of the LANDSAT-photos are parallel to the main mountainaxes and they are of indisputable impetance regarding the development of the basin of the Kis-Alföld.

f) *Rehabilitated-Rába-line* is the name of the southwestnortheast straight line from Kám (Rum) to Marcaltő. This line runs practically there where it was shawn on a basinbed map in 1958 by L. Kőrössy (see fig. 22.). Recently geophysicists doubted its existence (Molnár—Varga 1955), but it is an almost straight very definitely outlined but probably older breakline. But this lineament does not follow the recens valley of Rába, what is more its north-east part runs not on the gravel of the Rába but on that of the Marcal. Nevertheless this tectonical line has to be regarded as the famouos so-called Rába-line of geologists on the basis of the satellite-findings, because

19. The origin of the gravel of the Kis-Alföld after Szádeczky-Kardoss

1. wrenches in Pleistocene
2. wrenches in upper Pliocene
3. older Danube pebble
4. younger Danube pebble
5. right-coast pebblecover of Rába river
6. right-coast pebblecover of Gyöngyös river
7. left-coast pebblecover of Gyöngyös river
8. left-coast pebblecover of Répce river
9. left-coast pebblecover of Ikva river
10. pebbles from Marcal river
11. young terraces on the left-side of Rába river
12. young detrital cone of Rába and Répce rivers

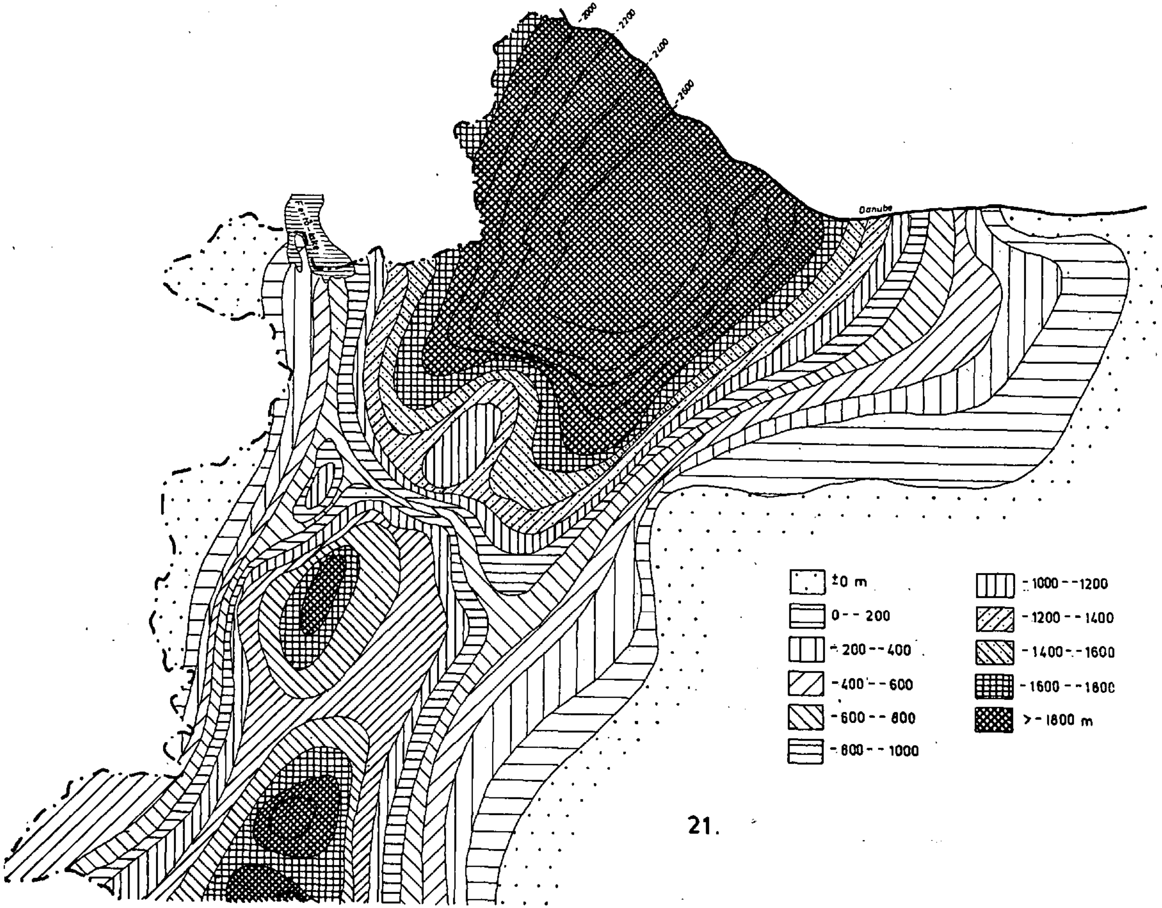


20. Underrelief map of Pliocène layers of the Kis-Alföld (after the map of L. Kőrössy)

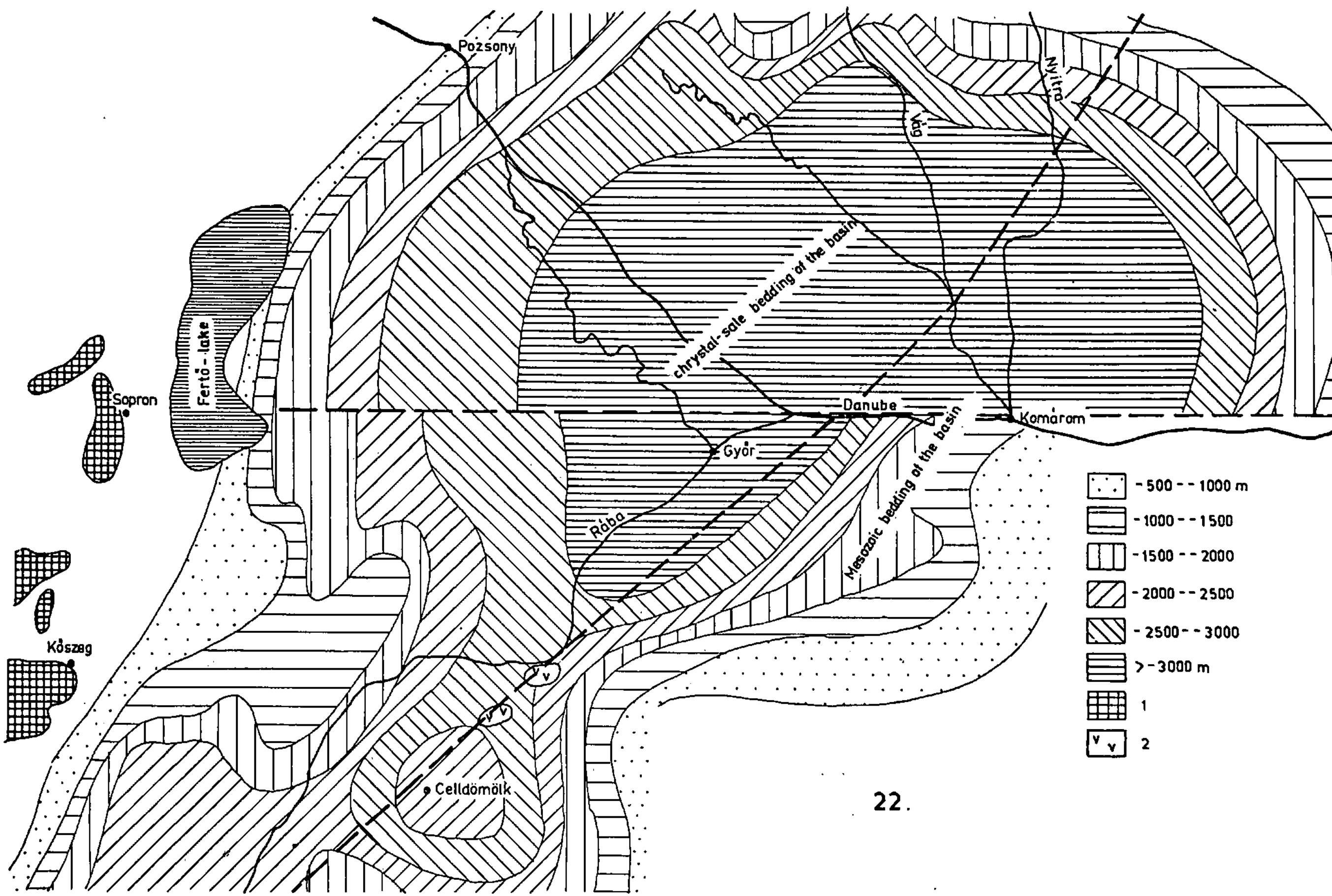
its constant macrostructural and regionlimiting characteristics is sharply defined. The Rába significantly turns to the west from this line in the district of Sárvár—Rábakecöl—Rábasebes presumably under the influence of the Répcelak—Rába-line a secondary tectonic lineament which can be drawn between Kám—Sárvár—Répcelak (se fig. 28.). The real (rehabilitated) Rába-line runs straightly towards Győr-újbarát to the north-northwest from Marcaltő but the river Rába draws away to the west from this part, too.

So it is clear that the most important line of the Kis-Alföld edge was not the outstanding factor for the recens bedalluviums of the Rába in contrast with the earlier ideas.

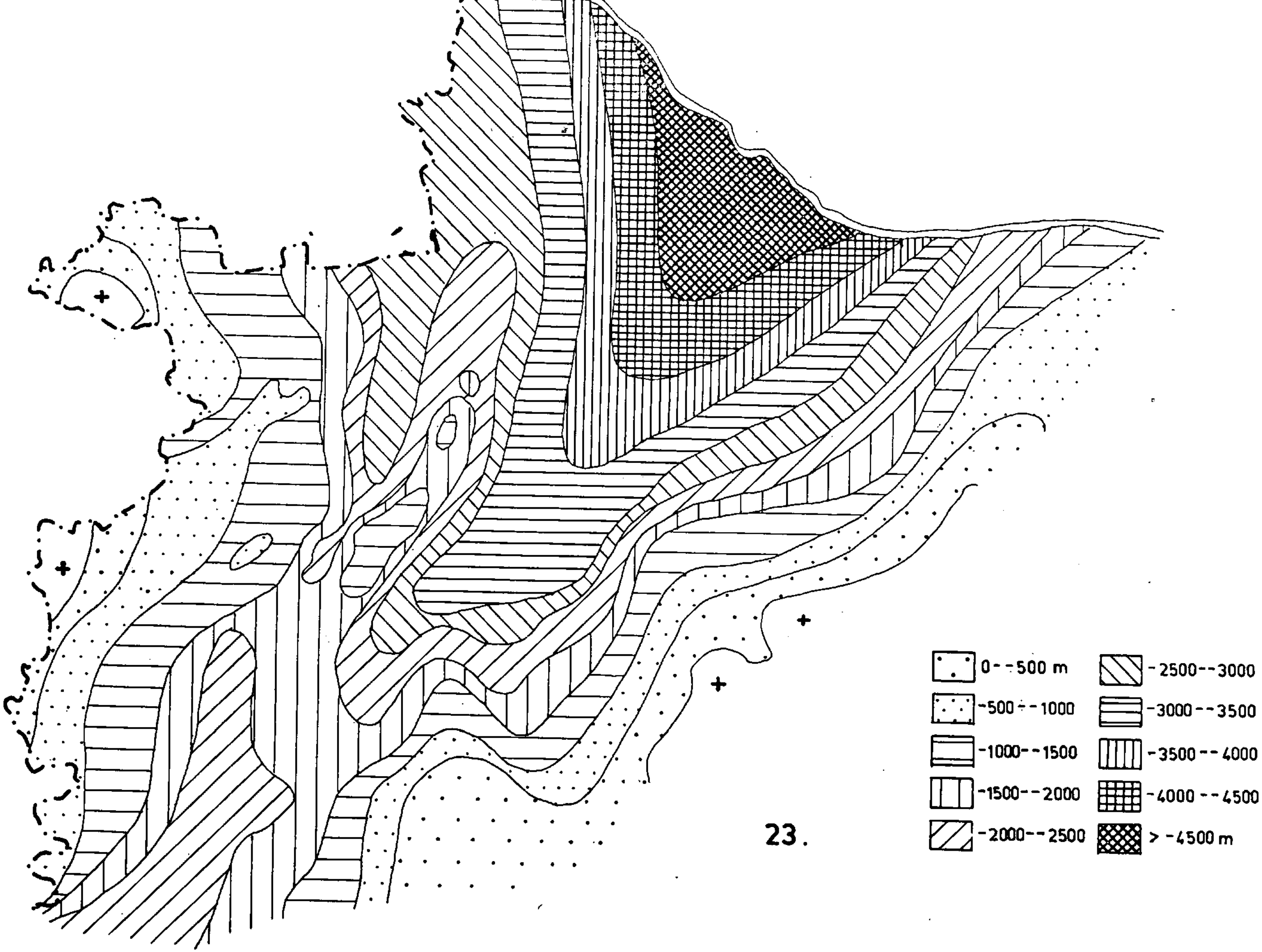
The curving of the Rába to the west of this line especially between Kám and Marcaltő is more striking because in this region the river gets tributaries building own alluvial cones only on its left bank, which ought to have pushed the Rába to the east in the direction of the Marcal this way. The fact that in contrast with this, this anomaly exists evidently refers to that the reach of the Rába from Kám to Répcelak was outlined by an effective tectonical sinking. But this tectonical zone got a role only during the youngest Holocene, in contrast with the Rehabilited—Rába-line not that much effecting the hydrological system today, but earlier being more effective and presumably geologically more permanent.



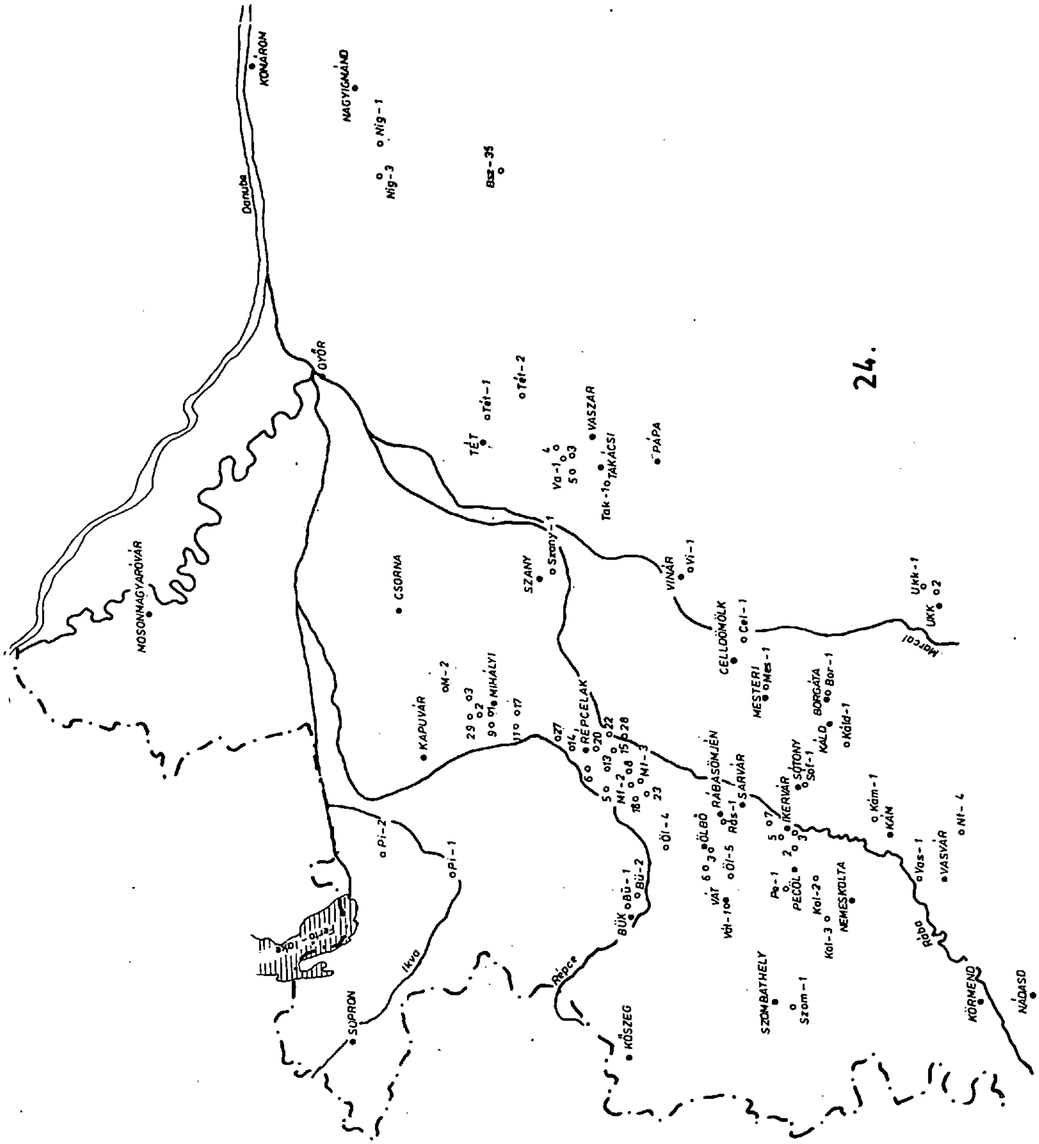
21. Underrelief of the Pannonian layers of Kis-Alföld (after E. R. Schmidt and G. Láng, 1958)



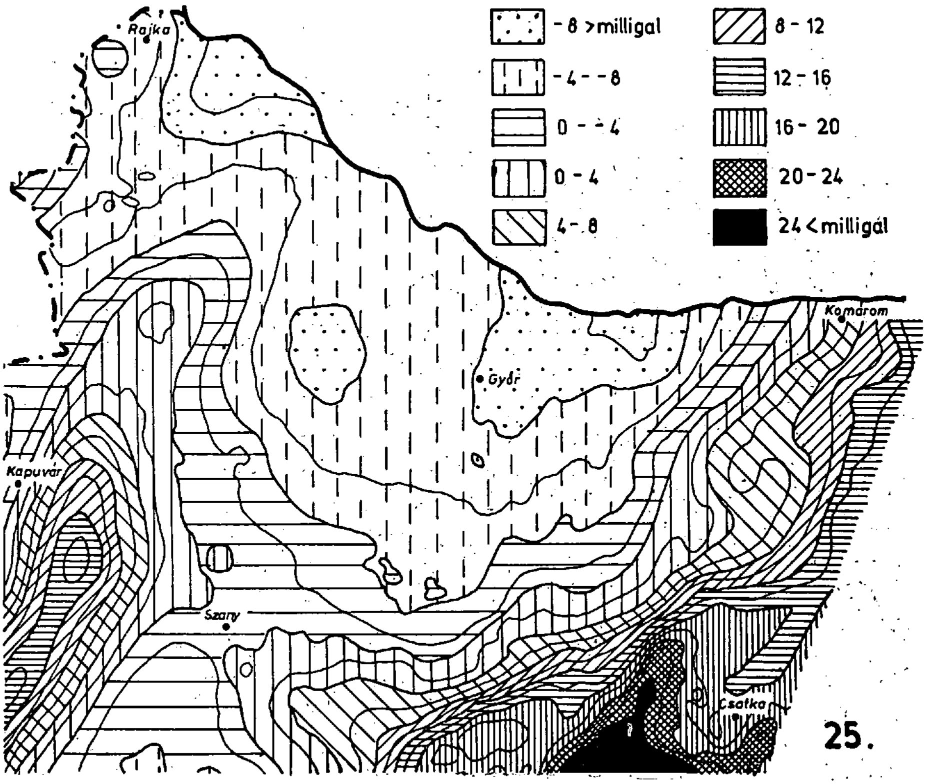
22. Reliefmap of the basinbed of the Kis-Alföld (based on the map of L. Kőrössy, 1958)
1. uncovered chrystal mountain
2. vulcanic mountain



23. Reliefmap of the Paleosoic and Mesozoic basement complex of Kis-Alföld
(based on the communications of V. Dank and J. Fülöp)


KOMÁROM
NAGYIGMÁND
Danube
GYŐR
TÉT
VASZAR
TAKÁCSI
PÁPA
MOSONMAGYARÓVÁR
CSORNA
SZANY
VINÁR
CELLDÖMÖLK
Marcal
UKK
KAPUVÁR
MIHÁLYI
RÉPCELAK
MESTERI
BORGÁTA
RÁBASÖMJÉN
SÁRVÁR
SÓTONY
KÁLD
IKERVÁR
KÁM
ÖLBŐ
VÁT
PECÖL
NEMESKOLTA
VASVÁR
Rába
SZOMBATHELY
KÖRMEND
NÁDASD
KŐSZEG
BÜK
Répce
SOPRON
Ikva

24.

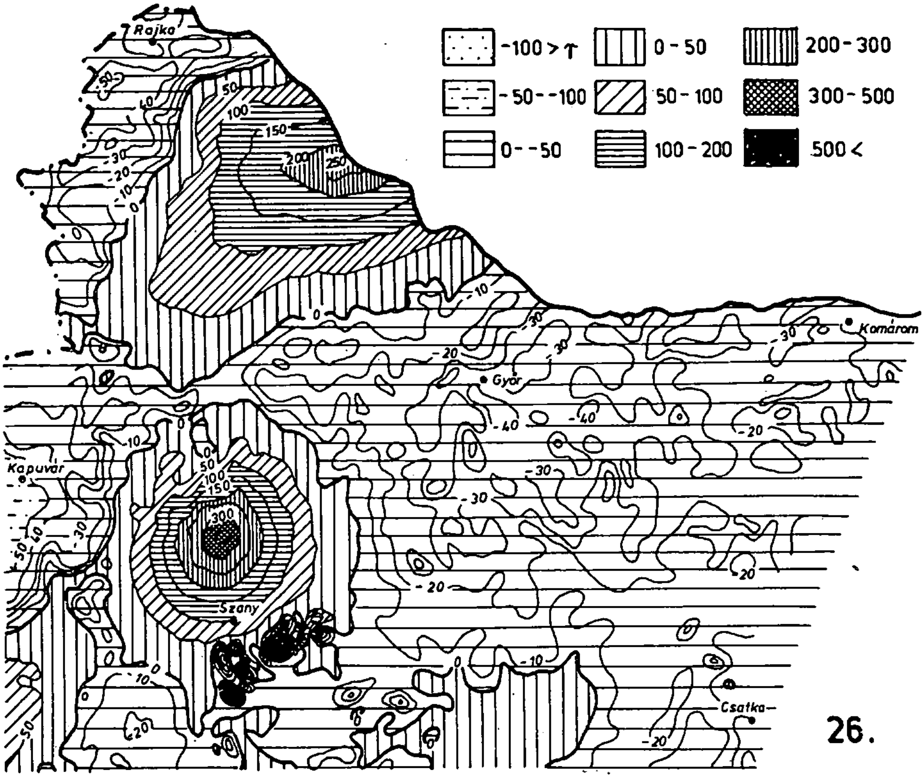


25. Gravitation isoanomaly map of the Kis-Alföld
(based on the data of ELGI

g) *Répcelak—Rába-line* (north-northeast-south-southwest) is a new structural line between Rum—Sárvár—Répcelak in the recens valley-plain of the Rába to the west of which there is a presumably more intensive bedsinking than on the western side of the lineamentum, on the basis of the interpretation of the satellite-findings. (see point f) too).

7. The siltation facies map of Rónai was made with the comprihensive elaboration of the borehol logs of Kis-Alföld, which shows the areal ratios of total thickness of the gravelsand layers (see fig. 17). It refers to an intensive Quarternary sinking-centre some kilometres far to the southeast of Csorna. The place of this complately coincides with the greatest fieldintensity anomalycentre of the geomagnetic map shown on fig. 26. But at the same time this region is not in a striking position neither on the maps showing gravitation isoanomalies (see fig. 25.) nor on those showing the relief

24. A general map of hydrocarbon searching deepborings considered while drawing the reliefmap of the basement complex of the Kis-Alföld
(based on the data of. V. Dank)



26.

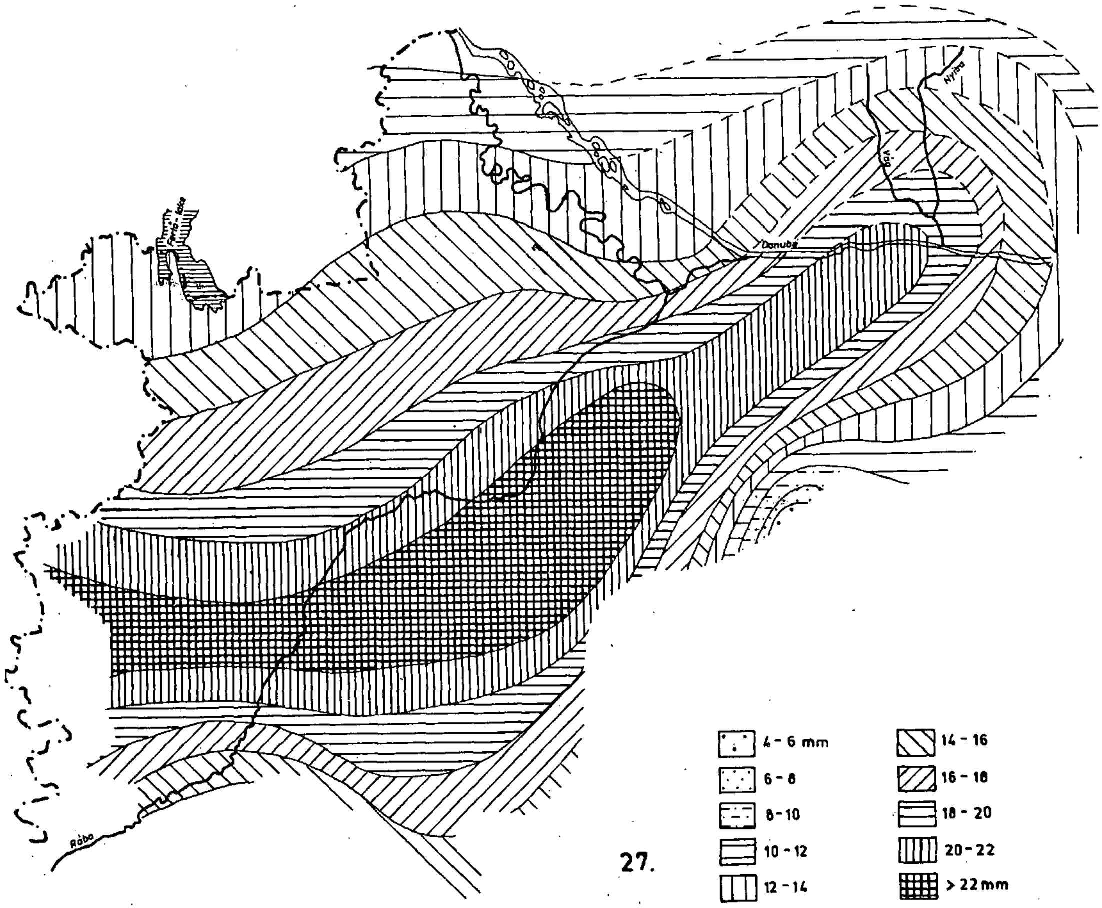
26. Geomagnetic isoanomaly map of the Kis-Alföld
(based on the data of ELGI)

of the basement complex (fig. 23.) or the underrelief of the Pannonian layers (fig. 21). But we did not get any indication in the region during the precise analyzis of the satellite-photos either. Today this area is covered by the edge of the alluvial cone of Rába, but it is close to the southern edge of the Holocene alluvial cone of the Danube, too.

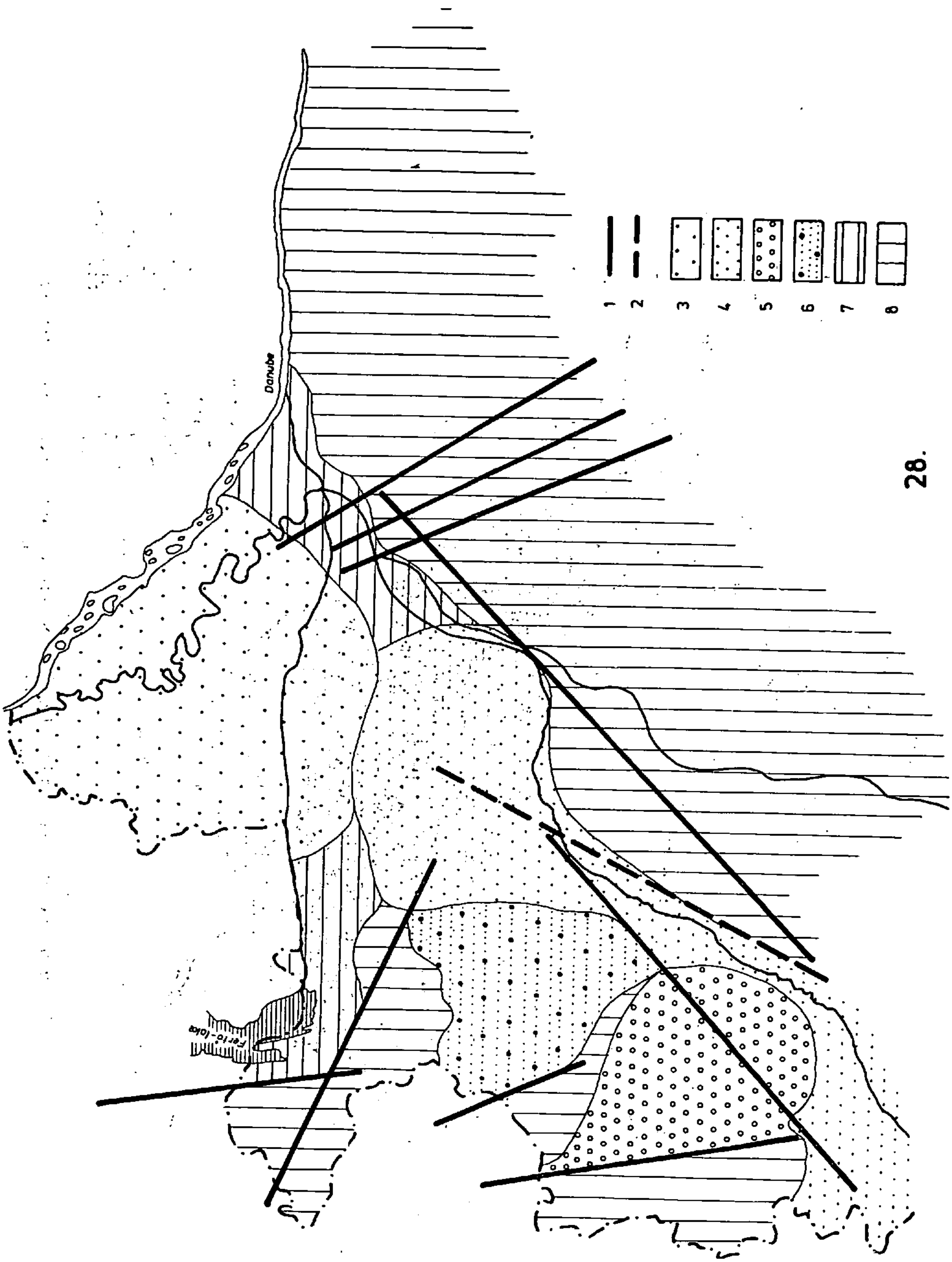
It follows from the foregoings that we have to regard the area near Csorna as one of the Quartenary sinkingcentres of the Kis-Alföld, but which was not an active local sinking during the Mesozoic and Terciary tectonisms yet.

The connections characteristis of the Quaternary sinking of Csorna are not effective any more in the case of the other vast positive geomagnetic anomalywith the centre Lipót—Ásványráró. For although the middle of this topographically comletely coincides with the vast Danubian sinkingcentre, which can be indicated in the basement complex relief and in the underrelief of the Terciary layers (see figs. 21. 23.!, the centre of the thickest gravel shifts from this deepbasin — centre to Mosonmagyaróvár i.e. 10—15 km-s far to the west.

Though the satellite-photos do not give further respect of interpretation to judigng the reasons of the question because of the recens alluvial cone of the Danube



27. The rate of geotectonical levelshift of the Kis-Alföld between 1883—1933 in mm-s
(based on the data of L. Bendefy)



28.

covering everything. But even without this it seems probable that the above-mentioned connections of layerspace indicate the earlier (mostly Terciary, mainly intrapannonian) negative levelshifts of the Ásványráró sinking-centre, and today the sinking-dinamics of the area of Ásványráró has declined considerably as compared to earlier phase. So the north-south line between Rajka—Mosonmagyaróvár—Csorna is most likely ot have an moment of sediment-laying and to indicate a neotectonical structure, but which does not appear on the relief of the surface smoothed by a very intensive siltation and in the satellite-findings.

Otherwise the geophysically analyzed refractional survay-data (Molnár—Varga, 1975) too, affirms the above explained conceptions for it seems to be proved on the basis of collection of data of OKGT GKÜ, too, that in the area of Csapod—Mihályi—Csorna besides the SW—NE and NW—SE breaks there exists a definitely recognizable W—E and N—S meridional breaksystem as well. Though geophisicists supposed the age of these breaks older on the basis of the position of the Quaternary coarse sedimentcentres, we still think of structural lineaments of Quaternary age or at least ones renewed in the Quaternary. We did not show this N—S structural zone on fig. 28. just because there we draw only those lineaments which are reflected on the LANDSAT-photos.

8. The experiment of our work of interpretation convinced us that informations of the satellite-photos of the Kis-Alföld do not present any basis for recognizing potential hydrocarbon accumulating structures or exactly hydrocarbon layers in the depth. In contrast with the LANDSAT-photos of the Kis-Alföld the long distance survaillances of the Kis-Alföld do not contain even indirect signsystem which could become of orienting importance in comparison with the traditional geological research materials.

We could take notice of only one circumstance that was not interpreted in the geological literature and which raised hopeful respects for searching in the earlier phase of our work but later comparing this with the deepgeological and geophysical informations our hopes vanished in this respect, too. We refer to the phenomenon reflected superly on the satellite-photos that the Rába and all of its leftbank tributaries flow round their own alluvial cones from the right (from the south). This seemingly regular phenomenon seems so tendentious with the Ikva, Répce and Gyöngyös, that we had to suppose the misjudgement of Szádeczky—Kardoss concerning the origin of the rightbank gravel of Gyöngyös (which can be seen of fig. 19) as a working theory, because analogically we thought this alluvial cone side to be of Pinka origin.

Unfortunately we could not decisively affirm the correctness of our own work of theory by examining the samples collected on the spot though the possible misjudgement of Szádeczky could not be excluded either.

28. Recens tectonical and regiongenetical map of the Kis-Alföld based on long distance interpretations

1. first-rate tectonic lineaments
2. second-rate tectonic lineaments
3. The surface part of Danube's recent alluvial cone
4. The surface part of Rába's recent alluvial cone
5. The surface part of the recent alluvial cone of Gyöngyös river
6. The surface part of the recent alluvial cone or Répce river
7. Sinking territory not compensated with recent river accumulation
8. areas of recent fluvial and areal washing

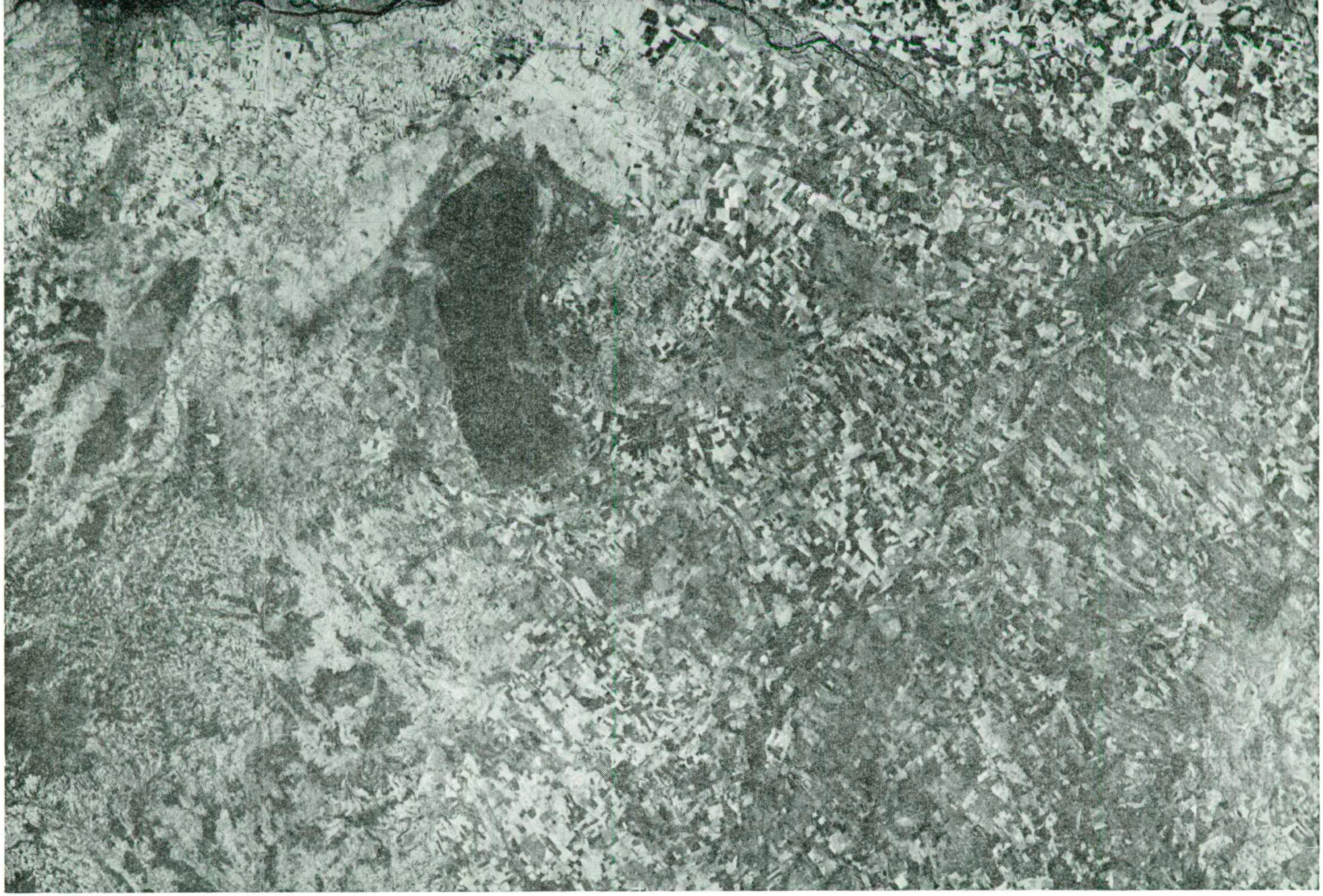
1. Negative spectrum photo of the Kis-Alföld with spectrum No 5 of the LANDSAT—I on Nov., 1973 1:500,000

2. Negative spectrum photo with spectrumNo 7, LANDSAT—II. on 23rd Aug., 1978 1:500,000

3. Sandwich system integrated spectrumcombination of the positive No 6 and negative no 6 spectrums of LANDSAT — photos of the Kis-Alföld on 23 Aug., 1978 1:500,000

4. Spectrum No 7, negative spectrumpicture of LANDSAT—II photo of the Kis-Alföld on 20th May 1979 1 : 500,000

5. Positive No 5 and negative No 5, sandwichsystem integrated spectrumcombination of the LANDSAT—II-photo of Kis-Alföld on 20th 1979 1:500 000



6. Positive No 7 and negative No 7, sandwich-system integrated spectrumcombination of LANDSAT—II-photo of Kis-Alföld on 20th May, 1979 1:500,000

Anyway it makes us think that all Hungarian leftbank tributaries of the Rába flow first to the SE then change their direction semicircularly and run on to the East or northeast. The phenomenon could refer to connections with deep anticline-structures only in that case if the well-known physicogeographical conditions which make the lower mouth-reaches of tributaries shift, could be excluded from the evoking factors. But we proved with thorough sedimentstructural examinations that the changing bed-directions if the leftbank tributaries of the Rába-riversystem in this area was evoked actually by the more dinamical silting up of the Rába-terraces and the accompanying aggravated ability of taking tributaries.

Unfortunately neither the direct satellite-informations nor their comparison with the geological reference-datas could give further correctly appreciable reasons or respacts for searching on to the discovery of yet unknown layers of raw materials of building industry. For what could be read on the satellitephotos i.e. plenty of utilizable coarse gravel accumulated in the different alluvial cones and terraceplains has been known exactly what is more in this respect we have reliable and detailed reserve measurings of the Kis-Alföld.

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